SSP 50062

Canadian Space Agency
Space Station Program

NASA/CSA Bilateral Safety And Mission Assurance Requirements

March, 1995

Canadian Space Agency

Agence spatiale canadienne

National Aeronautics and Space Administration
Space Station Alpha Program
Johnson Space Center
Houston, Texas

REVISION AND HISTORY PAGE

REV.	DESCRIPTION	APPROVAL	PUB. DATE
–	Initial Release (Reference SSCBD 000204, Eff. 07–27–95)	A. Poirier	07–24–96

SPACE STATION PROGRAM

NASA/CSA BILATERAL SAFETY AND

MISSION ASSURANCE REQUIREMENTS

March 1995

LIST OF CHANGES

March,1995

None	First Issue

NASA/CSA BILATERAL

PRODUCT AND MISSION ASSURANCE REQUIREMENTS

MARCH 1995

PREFACE

The CSA/NASA Bilateral Safety and Mission Assurance Requirements document is a joint National Aeronautics and Space Administration (NASA) and Canadian Space Agency (CSA) document which describes all safety and mission assurance requirements applicable to the Canadian Space Station Program (CSSP).

The contents of this document are derived from the baseline agreed between NASA/CSA at the S.S. Freedom program managers meeting on November 15th, 1993 at St Hubert PQ, Canada.. The components of that baseline have been incorporated into one document and include Bilateral agreements in Materials and Processes and Safety Analysis reached under the ”meets or exceeds” process.

The Safety and Mission Assurance document is controlled through approval signatures, by the NASA Space Station Program Director and the CSA Program /Manager (MSS Director). Changes to this document are approved by NASA and CSA Program Managers at either Space Station Control Boards, or at NASA/CSA Bilateral Reviews. All changes require the written approval of both NASA and CSA Program Managers. After initial joint approval, NASA will maintain this S&MA document including the incorporation of approved changes.

R. H. Brinkley	4/24/96	/s/ Alain Poirier	Apr–18–96
R.H. Brinkley, Manager, Space Station Program	Date	Alain Poirier, Director General Space Station Program Office	Date

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

APPENDIXES

ANNEXES

1.0 INTRODUCTION

1.1 PURPOSE

This document establishes programmatic hardware and software safety and product assurance (reliability, maintainability, and Quality Assurance) requirements for the Canadian Space Station Program in the design, development, production, test, and operation of the MSS elements and components of the International Space Station Alpha.

1.2 SCOPE

These safety and product assurance requirements are applicable to all flight equipment, Orbital Support Equipment (OSE), Flight Support Equipment (FSE), and certain Ground Support Equipment (GSE) (as specified herein) and related software supplied for International Space Station Alpha.

The implementation of the requirements of this document may be tailored by CSA, as appropriate, consistent with International Space Station Alpha program objectives.

1.3 MANAGEMENT APPROACH

Management of safety and product assurance shall include the following:

1.3.A Defining the major hardware and software safety and product assurance tasks and assuring that they are performed as integral parts of all phases of the program

1.3.B Evaluating the safety, reliability, maintainability, and quality of hardware, software, and operations through analyses, tests, reviews, and assessments

1.3.C Providing timely status reporting through periodic project reviews and as a part of overall project status reports

1.3.D Ensuring compatible safety and product assurance requirements among manufacturing, test, launch, and ground operations sites

1.3.1 A safety and product assurance management plan shall be prepared. This plan shall define the tasks and products of the Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA) activities of the CSSP and the organizational responsibilities for task implementation. The plan will provide visibility of SRM&QA activities to be accomplished during the life of the CSSP. Safety and product assurance management shall have direct unimpeded access to the management level having full project responsibility.

1.4 RELATION TO OTHER PROGRAM REQUIREMENTS

The Bilateral Safety and Mission Assurance Requirements document, SSP 50062 both responds, and is subordinate, to the requirements of the Joint Management Plan SSP 50022. The safety and product assurance analytical and verification requirements set forth in this document shall take precedence in cases of conflict with requirements contained in subtier documents. The safety and product assurance design requirements are contained in SSP 41167, MSS Segment Specification.

1.5 MOTIVATION

A product–oriented motivational (awareness) activity shall be implemented by the CSSP contractors as an integral part of and making maximum use of existing motivational activities. The objective of this activity shall be the prevention of human error by instilling in personnel an awareness of their personal responsibility for International Space Station Alpha success.

1.6 INDEPENDENT EVALUATIONS FOR NASA OR THE INTERNATIONAL PARTNERS

NASA and the CSA reserve the right to appoint independent representatives to assist in safety and product assurance evaluation activities. These representatives will provide technical support to the applicable parent organization and determine effectiveness of and recommend improvements for safety and product assurance activities.

1.7 DATA REQUIREMENT (DR) DESCRIPTIONS

DRs which define the applicable safety and product assurance documentation requirements for NASA International Space Station Alpha Program Elements (ISSAPEs) are included as appendix B of this document. CSA has the flexibility to add, combine, separate, or expand the DRs as appropriate but the basic DR requirements are mandatory.

1.8 SAFETY AND PRODUCT ASSURANCE DATA BASE

Safety and product assurance data bases shall be established and shall be compatible with the applicable technical and management information system requirements.

1.9 MILESTONE REVIEWS

Safety and product assurance activities shall include supporting internal and supplier design reviews, and NASA and CSA design and readiness reviews. Participation in milestone reviews shall assure that safety and product assurance requirements are adequately considered.

2.0 SAFETY

2.1 SAFETY MANAGEMENT

2.1.1 SAFETY APPROACH

Safety management activities shall be an integral part of the CSSP Design Development process, and shall be developed, planned, and implemented to assure that hazards and their consequences are identified, evaluated, and controlled during all phases of the CSSP Program. These activities shall provide an overall qualitative safety risk assessment including identification of residual hazards, and retention rationale for program management decision on acceptance. The safety program shall encompass all activities of the CSSP Program.

2.1.2 ORGANIZATION

Organization of the safety effort shall assure effective planning, management, implementation and performance of system safety, industrial safety, and test operations activities. While the accomplishment of all safety tasks may not be the responsibility of the same organizational element, management of the safety efforts shall assure that all tasks are effectively accomplished. Safety management shall have direct access and shall report regularly to the program/project manager who has the responsibility for risk management decisions.

2.1.3 SAFETY PLAN

The CSSP contractor safety organization shall prepare, implement, and maintain a plan which describes the compliance with requirements set forth herein. The plan content shall be readily identifiable with each cited requirement and shall cover all safety activities.

2.1.3.1 A safety plan shall be prepared that describes the safety tasks to be performed and identifies the safety organization which provides the basis for coordinating the system safety, industrial safety, and test operations safety for all items. The plan shall cover concept definition, design, development, manufacturing, test, handling/transportation, preflight, mission including Alpha Assembly and Operations as applicable. This safety plan will integrate and describe the relationship of all safety activities. The safety plan shall be coordinated and integrated with the other program plans to avoid overlaps and conflicts among the technical disciplines. The plan will provide clear and concise definitions of each discrete task, task implementation methods, and task products. The safety plan shall be prepared in accordance with DR SSQ–S–001.

2.1.3.2 A launch site safety plan shall be prepared. The plan content shall be defined and agreed upon in coordination between the launch site safety office and the CSA . The plan shall be approved by the Launch Site Safety Office prior to first hardware delivery to the launch site. The plan will become appendix A of the safety plan and shall be in conformance will applicable launch site safety requirements.

2.1.4 SAFETY REVIEW REQUIREMENTS

2.1.4.1 Space Station Review and Certification. The CSSP will support the phase safety review process described in SSP 30599, Safety Review Process for International Space Station Alpha.

2.1.4.2 Space Station User Payload Safety Reviews. The payload developer shall perform hazard analyses for its payload. CSA shall conduct safety reviews for the payloads it sponsors and assess safety compliance in accordance with the requirements of NHB 1700.7B with ISSA addendum at major design reviews. NASA will be invited to attend these safety reviews. CSA shall participate in NASA safety reviews for payloads handled or serviced by the MSS, as a member of the Payload Safety Review Panel. CSA shall also be invited to attend all safety reviews on other payloads. CSA shall participate in the three phase review process with NASA at one level, the payload, integrated, or station integrated element component level as described in NSTS 13830, as modified for ISSA program.

2.1.5 Safety Audit Teams and Surveys. Safety Audit Teams selected from the applicable CSA or contractor organizations will be responsible for carrying out periodic safety audits and reviews of safety organizations, programs and activities. NASA observers will be invited to participate in the CSA audit and review activities. Likewise, the CSA will be invited to participate in NASA audit and review activities. NASA, as well as the CSA, shall have the right to participate in contractor and subcontractor safety surveys addressing an SSPE for which it has responsibility.

2.1.6 Operational Readiness Inspections (ORI)s. The safety organization shall provide for readiness inspections prior to performing any ground operation or test that is potentially hazardous; has a high risk in terms of program success; or involves hardware, facilities, or effort of significant expense. A safety assessment shall be made of facilities, test articles, support equipment, procedures, personnel training, experience, certification, and management. The safety organization will also assess previous ground test or operations data and perform visual inspection of the configuration. Operation Readiness Inspection results will be presented at the respective MSS element or MSS system level Acceptance or Safety Phase III review as appropriate.

2.1.7 Facility Safety Reviews. Reviews of facilities, equipment, handling and transportation operations, personnel certifications, procedures, fire protection systems, hazardous operations (e.g., high pressure systems, hazardous materials, etc.), and construction activities shall be made by designated contractor/governmental agency safety personnel as defined by government laws applicable at the particular site.

2.1.8 MISHAP REPORTING AND INVESTIGATION

Mishaps occurring during manufacturing, testing, and operations shall be investigated and reported as specified in the NHB 1700.1 (V1–A), ”Basic Safety Manual,” NHB 1700.1 (V2), ”Guidelines for Mishap Investigation [or CSSP specifications which meet or exceed NHB 1700.1 (VI–A) and NHB 1700.1 (V2)],” and reported in accordance with DR SSQ–S–006. Technical assistance shall be provided to NASA or CSSP boards investigating mishaps that are within their jurisdictions. The NASA or applicable CSSP organizations, including contractors and subcontractors, will cooperate fully with the investigation and will provide any records, data, trends, and other administrative or technical support and services.

2.1.9 SAFETY TRAINING AND CERTIFICATION

Personnel who perform hazardous operations and activities shall be appropriately trained and certified. The safety organization shall participate in the development of the training activities and shall approve the programs that are developed. Positions requiring training and certification shall be identified. A current record of certification status shall be maintained. Protective devices and emergency equipment shall be identified and included in safety training. Hazards will be brought to the attention of trainees. Proficiency demonstrations of training, to the degree feasible, will be required for hazardous operations. Personnel training and certification shall be in accordance with approved procedures and regulations applicable at the particular site.

2.1.10 WAIVERS AND DEVIATIONS

Safety shall evaluate proposed hardware, software, and operational waivers and deviations, and recommend disposition for management concurrence. A hazard report will be initiated, or an existing hazard report will be updated to show the status of the waiver or deviation.

2.2 SYSTEM SAFETY

2.2.1 SYSTEM SAFETY OBJECTIVES

The system safety objectives are to identify and evaluate MSS design and operational activities to assure that measures are taken to minimize risks. The system safety

objectives shall be accomplished using NHB 1700.1, System Safety Volume (or CSSP specifications which meet or exceed NHB 1700.1), to include the following:

2.2.1.A Performing safety analyses to identify the hazards associated with hardware, software, and operations during all program phases

2.2.1.B Assuring that proper design and performance requirements eliminating or controlling the identified hazards are developed, documented, and implemented

2.2.1.C Performing an overall risk assessment including the identification of residual hazards/risks and providing recommendations with supporting data and rationale for management awareness and decision on acceptance of the residual hazards/risks.

2.2.2 SYSTEM SAFETY TECHNICAL REQUIREMENTS

Safety technical requirements contained in SSP 41167, MSS Segment Specification shall be identified and incorporated in system design, operations, and procurement documentation including facilities, GSE, and flight hardware and safety critical software. A system to show compliance with these requirements shall be developed, implemented, and maintained. The verification system will be used to do the following: maintain current requirements documents and reference the next higher or lower requirement document, assure specific requirements are imposed, and report implementation status of requirements.

2.2.3 SAFETY ANALYSES

Safety analyses shall be performed in accordance with SPAR–SS–PP–0096 Safety Plan Space Station MSS and SPAR–SS–PL–0273 Instructions for the Preparation of Hazard analyses. SPAR–SS–PL–0273 provides instructions for performing analyses, implementing the safety risk management program, and applying criteria for qualitative and quantitative risk assessment. The development of these analyses shall be the responsibility of safety personnel. These analyses shall identify hazards and safety risks associated with system design including; hardware and, software (including GSE, FSE, and OSE), the operations and operational environments and shall be documented in accordance with DRs SSQ–S–002. The analyses and reports shall include the likelihood of occurrence for hazard causes and effects. The results of these analyses shall be evaluated formally through the design review and milestone review processes. Hazardous conditions, causes, effects, controls, and verification methods shall be identified and

documented. The Failure Modes and Effects Analysis (FMEA) shall not be used in lieu of safety analysis but, shall be used as an input to the safety analyses.

2.2.4 HAZARD ELIMINATION AND CONTROL

The foremost consideration for resolving hazards shall be to eliminate them by design through removal of hazard sources and hazardous operations. Corrective action priorities shall be established to achieve maximum benefit in reducing potential personnel and material losses. Actions for satisfying safety engineering requirements shall be in the following order of precedence:

2.2.4.A Hazard Elimination. The hazard source or the hazardous operation shall be eliminated.

2.2.4.B Design for Minimum Hazard. The major goal throughout the design phase shall be to ensure inherent safety through provisions of appropriate design features, materials and parts selection, and safety factors. Damage control, containment, and isolation of potential hazards and failure tolerance considerations are to be included in design considerations.

2.2.4.C Safety Devices. Known hazards which cannot be eliminated by design shall be reduced to an acceptable level by incorporating safety devices as part of the system, subsystem, or equipment.

2.2.4.D Warning Devices. Where it is not possible to preclude the existence or occurrence of a known hazard, warning devices shall be employed for the timely detection of hazardous conditions and the generation of adequate warning signals.

2.2.4.E Special Procedures. Where it is not possible to reduce the magnitude of an existing or potential hazard by design or by use of safety and warning devices, special procedures [including the requirement for Personal Protective Clothing/Equipment] shall be developed to counter hazardous conditions for enhancement of ground and flight crew safety.

2.2.5 HAZARD REPORT CLOSURE CRITERIA

A hazard report shall be considered closed only after at least one of the following conditions have been satisfied:

1) The hazard has been eliminated by a design or operational change, and the change has been implemented and verified or;
2) The hazard has been controlled in accordance with at least one of the corrective actions identified in paragraph 2.2.4.B through 2.2.4.E, and the controls have been verified by successful completion of the required design change, test programs, analytical studies, or training programs or;
3) The hazard has been accepted by program management in accordance with the criteria specified in SSP 30309, para. 5–4, Closure Status & Rationale.

2.2.6 HUMAN ENGINEERING

To minimize human errors, procedures and criteria shall be developed to assure that safety–related human engineering principles are applied in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA–STD–3000/T) or CSSP standard which meets or exceeds SSP 50005 to eliminate or mitigate potential hazards associated with the man–machine interface during design, development, manufacture, test, maintenance, and operation of the system or subsystem.

2.2.7 SPECIFICATIONS AND PROCEDURES REVIEW

Specifications, standards, and procedures for manufacturing, testing, maintenance, and operations shall be reviewed to assure that adequate personnel warnings are included and that the inherent safety of the design is preserved.

2.2.8 NASA OR CSA FURNISHED EQUIPMENT (GFE) SAFETY

Safety data needed for GFE shall be identified by the contractor or supplying agency and shall be supplied by the supplying agency. When examination of these data or testing indicates that GFE and/or GFE documentation is not consistent with the safety requirements of the International Space Station Alpha, the safety organization of the supplying agency shall be formally and promptly notified.

2.2.9 GROUND SUPPORT EQUIPMENT (GSE) SAFETY

The safety analysis approach described in paragraph 2.2.3 shall apply to GSE.

2.2.10 REVIEW OF CHANGES

When changes are proposed for equipment design (hardware and software) or procedures, the safety organization shall assure the identification and resolution of

hazards that may be introduced into the system. These hazards shall be documented on hazard reports per DR SSQ–S–002. Based on this review, the safety organization shall provide concurrence or nonconcurrence with proposed changes through participation in Configuration Control Board (CCB) activities.

2.2.11 REVIEW OF FLIGHT AND GROUND HARDWARE FAILURES

The safety organization shall review, provide recommendations and concur in failure resolutions associated with catastrophic and critical hazards including Criticality Category 1 items and also monitor lower criticality failure resolutions for safety impact. Safety participation in the failure resolution activity will be consistent with SSP 30223, Problem Reporting and Corrective Action System Requirements for the International Space Station Alpha Program

2.2.12 EVALUATION OF GROUND AND FLIGHT TEST RESULTS

Safety shall assure evaluation of the results of testing that verifies design safety compliance. Emphasis will be placed on test plans and procedures, reports, and verification of safety parameters.

2.2.13 EVALUATION OF MISSION OPERATIONAL ACTIVITY

Safety shall participate in mission operational activities and make safety evaluations of anomalous conditions. These safety evaluations will provide guidance to plan future activities and to establish necessary corrective actions. Identified hazards with resolution will be entered into the hazards data base for lessons learned purposes.

2.3 INDUSTRIAL SAFETY

Industrial and personnel safety functions for the MSSP shall be performed in accordance with the applicable, industrial safety and occupational health and safety government regulations at the particular site.

2.3.1 GROUND OPERATIONS SAFETY

Safety shall assure that safe methods are implemented for ground handling and operations of the flight equipment, test equipment, and associated GSE to assure that hardware, software, personnel, and facilities are protected during handling, operations and storage.

2.4 TEST OPERATIONS SAFETY

2.4.1 EVALUATION OF SAFETY MARGINS

Safety shall assure that required design margins exist for hardware and functions and that design margins are verified by either test or analyses. Which of these methods of verification shall be used shall be specified in the specification verification matrices.

2.4.2 TESTING OF SAFETY CRITICAL EQUIPMENT

Safety shall review test plans before ground and on–orbit testing of safety critical equipment. The review must assure that the test plans include verification of hazard control and that personnel, facilities, hardware, and software are protected.

2.4.3 TEST OPERATION REVIEWS

Reviews of facilities, equipment, and procedures shall be made by designated safety personnel prior to test initiation. Detailed test procedures and related documents for hazardous testing and operations shall be reviewed and approved by the responsible safety personnel.

2.4.4 SAFETY MONITORING

Hazardous tests and operations shall be monitored to assure that safety requirements are being met and approved procedures are being used.

3.0 RELIABILITY AND MAINTAINABILITY

3.1 MANAGEMENT

Reliability and maintainability activities shall be planned and developed to be an integral part of MSS design, development, test and evaluation, and operational activities. Scheduled status reporting will be used to provide visibility and assist in controlling the reliability and maintainability effort. Objectives will be to plan and establish the reliability and maintainability effort; to define the major reliability and maintainability tasks and their place as an integral part of the design and development process; to assure the effective implementation of reliability and maintainability requirements; to evaluate system reliability and maintainability characteristics through a program of analysis, review, and test/demonstration; and to conduct trade –off studies between reliability, maintainability, and related disciplines to establish optimum availability.

3.1.1 ORGANIZATION

Organization of the reliability and maintainability efforts shall assure effective planning, management, implementation, and performance of reliability and maintainability activities. While the accomplishment of all reliability or maintainability tasks may not be the responsibility of the same organizational element, management of the reliability and maintainability efforts shall assure that all tasks are effectively accomplished. Reliability and maintainability management shall have direct access and shall report regularly to program/project management.

3.1.2 PLANS

3.1.2.1 RELIABILITY PLANS

The CSSP reliability organization shall prepare, implement and maintain an integrated reliability plan which describes the compliance with requirements set forth herein. The plan content shall be readily identifiable with each cited requirement and shall cover all reliability activities. Reliability plans for separate sites shall be governed by self–contained, separate sections of the overall reliability plan or by a separate plan written for each site. Those sites for which a separate plan is required shall be identified. The reliability plans shall describe how the reliability requirements will be implemented, controlled and verified and shall be prepared and maintained in accordance with DR SSQ–R–001.

3.1.2.2 MAINTAINABILITY PLANS

The contractor maintainability organization shall prepare, implement and maintain an integrated maintainability plan which describes the compliance with requirements set

forth herein. The plan content shall be readily identifiable with each cited requirement and shall cover all maintainability activities. Maintainability plans for separate sites shall be governed by a self–contained, separate sections of the overall maintainability plan or by a separate plan written for each site. Those sites for which a separate plan is required shall be identified. The contractor maintainability plans shall describe how the maintainability requirements will be implemented, controlled and verified and shall be prepared and maintained in CSA approved format.

3.1.3 AUDITS AND SURVEYS

The reliability and maintainability efforts shall include contractor internal audits and vendor/supplier surveys to evaluate the progress and effectiveness of reliability and maintainability activities and to determine the need for adjustments or changes. Audits and surveys shall be conducted regularly at intervals as defined by the reliability and maintainability plans.

3.1.4 SUPPLIER CONTROL

3.1.4.1 SUPPLIER RELIABILITY AND MAINTAINABILITY CONTROL

The reliability and maintainability efforts shall assure that hardware obtained from any source meets the reliability and maintainability requirements of the CSSP. This applies to items obtained from contractors, subcontractors, or suppliers, or whether the item is obtained by an intracompany order from any organization. Management controls shall be provided to assure the adequacy of subcontractor implementation of the requirements. The level of requirements imposed on subcontractors and suppliers shall be appropriately tailored and identified to be consistent with those imposed on the contractor.

3.1.4.2 OFF THE SHELF HARDWARE EVALUATION

When off–the–shelf hardware is proposed for use, the selection of that hardware shall be based on its intended application and historical reliability and maintainability such as other contractor and program requirements and operations experience. If the historical data are not available or cannot be readily obtained, the reliability and maintainability characteristics shall be based upon analyses factors such as operating stress levels, derating, FMEAs, and logistics support considerations. The results of the examination of these data analyses shall be documented and additional controls, as appropriate, shall be applied to assure that the hardware meets all applicable requirements prior to procurement authorization.

3.1.5 NASA OR CSA FURNISHED EQUIPMENT (GFE) RELIABILITY AND MAINTAINABILITY

Reliability and maintainability data needed for GFE shall be identified by the contractor or supplying agency and shall be supplied by the supplying agency. When examination of these data or testing indicates that GFE/ and/or GFE documentation is not consistent with the reliability and/or maintainability requirements of the CSSP, the supplying agency shall be formally and promptly notified.

3.2 RELIABILITY AND MAINTAINABILITY ENGINEERING

Reliability and maintainability engineering tasks shall be accomplished, to the extent specified, for all flight equipment, flight support equipment, orbital support equipment, and ground support equipment which could cause personnel injuries or damage to the facility or which interfaces with flight hardware (including GFE. All maintainability activities shall be consistent with the International Space Station Alpha maintenance concept described in SSP 50011–03 Rev A, Concept of Operations and Utilizations. Maintainability engineering efforts shall support maintenance planning efforts as appropriate.

3.2.1 RELIABILITY AND MAINTAINABILITY DESIGN CRITERIA

The reliability and maintainability efforts shall include the establishment of reliability and maintainability design criteria and assure that the criteria are incorporated in each design. The reliability and maintainability efforts shall include a systematic approach for reviewing and concurring in design and procurement specifications and in design changes to assure that all design items reflect proper and complete reliability and maintainability design criteria and that the specifications contain applicable reliability and maintainability requirements.

3.2.2 RELIABILITY AND MAINTAINABILITY ANALYSES/TRADE STUDIES

3.2.2.1 RELIABILITY ANALYSES/TRADE STUDIES

The reliability effort shall include participation in design trade off studies and assessments utilizing reliability modelling and numerical predictions as appropriate. Reliability criteria, such as failure modes and effects, frequency of failures, and operating life, shall be evaluated as part of engineering and operational trade studies.

3.2.2.2 MAINTAINABILITY ANALYSES/TRADE STUDIES

The maintainability effort shall include participation in design trade off studies and assessments utilizing maintainability modelling and numerical predictions as appropriate.

Maintainability criteria, such as mean–time–to–repair, restorability considerations and maintenance crew time shall be evaluated as part of engineering and operational trade studies.

3.2.3 HARDWARE FAILURE MODES AND EFFECTS ANALYSES (FMEA)S

A system for preparing, maintaining, and controlling FMEAs shall be established in accordance with SSP 30234, Instructions for Preparation of Failure Modes and Effects Analysis and Critical Items List for Space Station, or CSSP documentation that meets or exceeds SSP 30234, and the applicable DR SSQ–R–002.

3.2.3.1 Flight Hardware FMEAs. FMEAs shall be prepared to the component level to ascertain the hardware functional criticality. For Criticality 1 and 2 single failure points and Criticality 1R items which do not meet the failure tolerance requirements of SSP 41167, MSS Segment Specification, analysis shall be performed within the component to the level necessary to identify all potential failure modes. The FMEAs shall be used as part of an ongoing process throughout the program to identify single failure points as candidates for elimination and to indicate where program failure tolerance requirements are not being met. It is also required that interfaces between the various subsystems and systems be addressed in the FMEA.

3.2.3.2 GSE FMEAs. GSE FMEAs shall be prepared in accordance with SSP 30234 Instructions for Preparation of FMEAs and CIL for Space Station. The GSE FMEA task may use information from the safety analysis task to preclude duplication of analytical work and documentation. (Refer to paragraph 2.2.3)

3.2.3.3 PAYLOAD FMEAS

All payloads shall be analyzed to determine any unsafe effects of payload failure which could propagate across the interface between the payload and the International Space Station Alpha. Payload FMEAs shall be prepared to the component level, to ascertain the hardware functional criticality, and shall be formally documented only for those functions containing failure modes which could cause Criticality Categories 1 and 2 effects.

3.2.4 CRITICALITY CATEGORIES

Criticality Categories shall be as defined in SSP 30234 Instructions for Preparation of FMEAs and CIL for Space Station.

3.2.5 CRITICAL ITEM CONTROL

3.2.5.1 Critical Items List (CIL) Preparation. Based on results of the FMEAs, a CIL, which includes retention rationale, shall be prepared in accordance with SSP 30234 and DR SSQ–R–003. The CIL shall consist of those items identified in the FMEA which meet the criteria in SSP 30234.

3.2.5.2 CIL Controls. CIL items shall be controlled in accordance with the requirements of SPAR–SS–PP–0097 Reliability Plan.

3.2.5.3 CIL Prioritization. The CIL shall be prioritized in accordance with SSP 30234.

3.2.6 RELIABILITY AND MAINTAINABILITY DATA

Reliability and Maintainability data shall be compiled for all flight hardware in accordance with DRs DID P.1101–29 and DID P.1101–512.

3.2.7 LIMITED–LIFE ITEMS

The life–limiting criteria and characteristics for limited–life items shall be established, and limited–life items shall be identified including GFE specified by the supplying agency. The status of limited–life items shall be recorded in accordance with paragraph 4.5.2.A and reported to enable refurbishment and replacement of these items and projection of their remaining life. Limited–life hardware identification and status reporting shall be in accordance with DR SSQ–R–004.

3.2.8 MILESTONE REVIEWS

Reliability and maintainability activities shall include supporting internal and supplier design reviews and NASA and CSA design and readiness reviews. Participation in reviews shall assure that reliability and maintainability requirements are adequately considered in decisions which affect hardware design, manufacturing, configuration controls, initiation of subsystem and integrated testing, shipment and readiness for flight.

3.2.9 REVIEW OF CHANGES

When changes are proposed for equipment design (hardware and software) or procedures, the change shall include a review of the reliability and maintainability impact

of the proposed change. Based on this review, the reliability and maintainability organization shall provide concurrence or nonconcurrence with proposed changes through participation in Configuration Control Board (CCB) activities.

3.2.10 PROBLEM REPORTING SYSTEM

Reliability and maintainability activities shall support the problem reporting system as defined in paragraph 4.7.6 of this document.

3.2.11 VERIFICATION ASSURANCE

Reliability and maintainability shall assure that an effective verification program for reliability and maintainability requirements is established and implemented. Reliability and maintainability activities shall include participation in such verification processes as development, certification, acceptance, checkout and maintainability verification. The reliability and maintainability plans shall delineate the degree of participation.

3.3 ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) AND MECHANICAL PARTS CONTROL

3.3.1 ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) PARTS

3.3.1.1 General. A system shall be developed and implemented in accordance with SPAR–SS–PL–0192 MSS Program Plan for EEE and Mechanical Parts and SPAR–SS–SG–0536 EEE Parts Requirements for MSS Program . The requirements of these documents will be used for assessing the acceptability of off–the–shelf designs or equipment, or for identification of required changes during the review prior to the procurement decision.

3.3.1.2 EEE Parts Selection. EEE parts shall be selected on the basis of suitability for their applications and proven qualifications to the requirements of their specifications. Selection shall minimize the number of styles and generic types. Parts with proven technologies and with inherent reliability features will be selected. In order to support projected life of International Space Station Alpha parts, selections of obsolete or impending obsolescent devices or technologies are to be avoided.

Approved parts for International Space Station Alpha use are those devices listed in SPAR–SS–R–0930 MSS Preferred Parts List (which also invokes SSP 30423, Space

Station Approved Electrical, Electronic, and Electromechanical (EEE) Parts List (SSAEPL) and MIL–STD–975, NASA Standard Electrical, Electronic, and Electromechanical Parts List).

3.3.1.2.1 Flight Hardware Including Flight and Orbital Support Equipment. EEE parts for criticality 1, 1R, 2, 2R hardware shall be selected from the SSAEPL or the Grade 1 listing of MIL–STD–975 or , equivalent Grade 1 EEE parts from the respective CSSP Approved Parts List. EEE parts for criticality 3 hardware shall be selected from the SSAEPL or the Grade 1 or Grade 2 listing of MIL–STD–975 or the equivalent Grade 1 or Grade 2 EEE parts from the respective CSSP Approved Parts List. EEE parts proposed for use and not specified on the SSAEPL or MIL–STD–975 are non–standard and require completion of a Non–Standard Part Approval Request (NSPAR) in accordance with SPAR–SS–PL–0192 . All non–standard parts require NSPAR approval prior to procurement and use.

3.3.1.2.1.1 All CSSP NSPARs shall require approval by the CSA. CSA shall submit a summary of all their approved NSPARs for NASA review. The summary shall be submitted for each step of the NSPAR process and shall contain, as a minimum, NSPAR number, procurement specification number, generic part number, part description, manufacturer, and NSPAR step approval date. The contractor shall monitor status at all levels of procurement, test, and fabrication to assure that all changes to nonstandard parts procurement plans are properly and expeditiously approved.

3.3.1.2.1.2 When selecting nonstandard parts, particular attention shall be devoted to the use of current data on the proposed part type, applicability on the basis of qualification, and adequacy of specifications. The results of the selection effort will determine requirements for additional screening, acceptance, and qualification testing.

3.3.1.2.1.3 The order of precedence for the selection of alternative parts for NSPAR approval shall be as follows:

1) Joint Army Navy (JAN) S, class ”S”, or Established Reliability Military Specifications.
2) Parts which have been identified by existing specifications as being Item 1 ”Equivalent” high Reliability parts.
3) Those parts requiring a new specification drawn to International Space Station Alpha requirements.
4) Lower grade parts procured to an existing specification and upgraded by screening tests shown in the closest military specification of Item 1.

3.3.1.2.2 Ground Support Equipment (GSE). For GSE, MIL–STD–975 Grade 2 parts are preferred. However, commercial end items or parts may be used when they satisfy the GSE function, will not degrade the safety or reliability of the flight system, and are used in a manner consistent with their documented design intent. GSE parts that physically interface with flight hardware (connectors, cable, wire, etc.) shall be of at least the same grade as the interfacing flight components.

3.3.1.2.3 Off–The–Shelf (OTS) Equipment and Off–The–Shelf Design. The contractor shall be responsible for assuring flight, FSE, or OSE OTS hardware and design compliance to the EEE part selection criteria for the proposed applications and corresponding criticalities. The contractor shall differentiate between OTS hardware or design that has not been used in spaceflight versus previously flown spaceflight hardware. CSA review and approval shall be required for the use of all EEE parts identified as defined below. The contractor shall provide CSA, who will provide NASA with the as built or as designed parts list, identifications made, and all supporting documentation. A summary of this data should also be provided.

3.3.1.2.3.1 Off–The Shelf Hardware (no spaceflight history).The evaluation of OTS hardware that has no previous spaceflight history shall include the following:

1) A review of the as–built EEE parts list (or equivalent list) and supporting documentation (e.g. procurement specifications, upgrade specifications, waivers, deviations, etc...); identifying to CSA all EEE parts which do not meet the selection criteria for the corresponding criticality.
2) A review of the as–built parts list for any parts that appear as restricted or suspect items in SPAR–SS–SG–0536 and SPAR–SS–PL–0192, identifying to CSA all EEE parts appearing as such.
3) A review process considering and identifying any available prior history of successful operation, failures, and causes of failures for EEE parts in the proposed hardware. For criticality 3 items; identification of Underwriters Laboratory (UL) approval, Consumer Product Safety Commission history, and user community operation performance are good sources of information.
4) A review identifying construction history, Government–Industry Data Exchange Program (GIDEP) alerts, and manufacturer for the EEE parts.

3.3.1.2.3.2 Off–The–Shelf Hardware (spaceflight proven).The evaluation of OTS hardware that has proven spaceflight history shall include the following:

1) A review of the as–built EEE parts list (or equivalent list) and supporting documentation (e.g. procurement specifications, upgrade specifications, waivers,

deviations, etc...); identifying to CSA all EEE parts which do not meet the selection criteria for the corresponding criticality.

2) An identification of any known life limiting items within the equipment and determination of expected useful life.
3) A review identifying construction history, Government– Industry Data Exchange Program (GIDEP) alerts, and manufacturer for the EEE parts.

3.3.1.2.3.3 Off–The–Shelf Design (no spaceflight history).The evaluation of OTS designs with no spaceflight history shall include the following:

1) All the requirements specified in 3.3.1.2.3.1 above, except the data shall pertain to the as–designed parts list.
2) An identification of higher reliability parts for possible direct replacement of EEE parts in the as– designed parts list that do not meet International Space Station Alpha selection criteria and order of precedence for the corresponding criticality.
3) An identification/review of any available derating and worst case analysis of the design; providing to CSA all analysis data.
4) An identification of any known life limiting factors that may affect the intended useful life of the hardware in the application; providing to CSA the failure mode and/or mechanism where available.
5) An identification of any known obsolete or unavailable EEE parts appearing in the as–designed parts list; providing to CSA a listing of all such parts, rationale for acceptance of obsolete or unavailable parts, and recommendation for replacement parts.

3.3.1.2.3.4 Off–The–Shelf Design (flight proven). The evaluation of OTS designs with proven spaceflight history shall include the following:

1) All the requirements specified in 3.3.1.2.3.2, except the review shall pertain to the as designed parts list.
2) An identification of higher reliability parts for possible direct replacement of EEE parts in the as– designed parts list that do not meet International Space Station Alpha selection criteria for the corresponding criticality.
3) An identification of any available derating and worst case analysis of the design; providing to CSA all analysis data.
4) An identification of any known life limiting factors that affect the intended useful life of the equipment in the application; providing to CSA the failure mode and/or mechanism where available.
5) An identification of any known obsolete or unavailable EEE parts appearing in the as–designed parts list; providing to CSA a listing of all such parts, and rationale for acceptance of obsolete or unavailable parts.

3.3.1.2.4 Canadian Space Agency. EEE parts selected for use on International Space Station Alpha by the CSSP shall be listed in one of the following documents:

1) SPAR–SS–R–0930 MSSP Preferred Parts List .
2) SSP 30423, Space Station Approved Electrical, Electronic, and Electromechanical Parts List (SSAEPL).
3) MIL–STD–975, ”NASA Standard Electrical, Electronic, and Electromechanical Parts List.

3.3.1.3 EEE Parts Specifications. All selected parts shall be controlled by specifications which shall include: (1) complete identification of the part; (2) physical, material, environmental, and performance requirements; (3) reliability and quality requirements including qualification inspections and tests, acceptance inspections and tests with reject criteria, and manufacturers configuration controls, process controls, and quality system; (4) special explicit requirements such as screen and burn–in, X–ray, radiation, positive particle protection [coatings, getters, Particle Impact Noise Detection (PIND)], and Electrostatic Discharge (ESD) controls; (5) packaging, storage, and handling requirements; (6) identification data requirements; (7) data retention and submittal requirements; (8) source inspection; (9) identification of source inspection (i.e. NASA, or International Partners or their delegates); and (10) access to data.

3.3.1.3.B All non–standard EEE part specifications shall be submitted as part of the NSPAR.

3.3.1.4 EEE Parts Qualification. All selected parts shall be supported by qualification at the parts level. Parts listed in MIL–STD–975, and qualified parts listed in the SSAEPL are considered qualified for all International Space Station Alpha applications when applied within specified performance limits. Parts listed in the MSSP Preferred Parts List are considered qualified for the appropriate CSSP applications when applied within specified performance limits. Standard parts applied in applications beyond specified performance limits and unqualified NASA or CSSP SSAEPL parts must be qualified to the desired performance levels. Nonstandard or modified parts shall be qualified on the basis of test or similarity as follows:

3.3.1.4.A Qualification of EEE parts shall be at the part level to the specifications requirements. The qualification approach for nonqualified nonstandard parts will be identified in the NSPAR . After concurrence with the selection of and specification for the nonstandard part, part qualification test procedures shall be developed, and testing equivalent to that performed on the applicable standard part shall be conducted to determine that the parts meet all specification requirements when equivalent, current, and applicable qualification data are not available.

3.3.1.4.B Part qualification data shall be maintained by the contractor for the life of International Space Station Alpha. Parts shall be requalified for new procurements when design, materials, manufacturing processes, or quality controls are altered or when facilities are relocated. The parts requalification shall require retesting or analyses corresponding to the extent of the change. The applicable NSPAR will be revised and resubmitted to identify the respective change.

3.3.1.4.C Qualification test procedures and test reports shall be developed and submitted in accordance with SPAR–SS–SG–0536.

3.3.1.4.D A data file, which identifies the basis for and substantiates the status of qualification for each EEE part type used shall be maintained excluding standard parts listed in MIL–STD–975, the SSAEPL, existing military parts with applicable qualification data ,and equivalent EEE part types identified in the CSSP Approved Parts List. The file for each part type shall be prepared in accordance with SPAR–SS–SG–0536.

3.3.1.5 EEE Parts Lists. Two types of EEE parts lists are required for ISSA ; component as–designed EEE parts list and component as–built EEE parts list. These lists shall be developed, submitted, and maintained in accordance with SPAR–SS–PL–0192 . Both EEE parts lists shall be submitted to the CSA EEE parts manager. For the component as–designed lists, provisions shall be made to assure that the responsible CSA organization approves all selected nonstandard parts listed prior to parts procurements. For the component as–built lists, provisions shall be made to assure that the delivered components have been built in accordance with the approved design.

3.3.1.6 EEE Parts Application Reviews. Parts applications and stress levels in the design of each component (black box) shall be reviewed. The results of these reviews will be documented in accordance with SPAR–SS–SG–00536. Overstress conditions will not be accepted unless previously documented and approved. The reviews shall include the anticipated life requirements, functional and environmental usage stresses, and historic and current failure experience (i.e., results of analyses of parts failures that have occurred in higher level assemblies on the same system or other projects). Special attention shall be given to non–standard parts. Results of the reviews shall be used to make technical and management decisions regarding circuit redesigns, alternative parts selections, and plans for additional qualification and acceptance testing. Action shall be taken to correct identified deficiencies or provide justification for each such usage in accordance with paragraph 3.3.1.12.

3.3.1.7 Derating Criteria. For generic part types specified in MIL–STD–975, the electrical parameter derating shall be in accordance with Appendix A of MIL–STD–975 or for the CSSP, in accordance with derating criteria which meets or exceeds Appendix A. EEE part types not addressed by these documents shall have the electrical parameters derated in accordance with SPAR–SS–SG–0536 or a similar document that, as a minimum, requires a 25 percent derating of parameters specified for comparable device types in MIL–STD–975. Part types with comparable devices listed in MIL–STD–975 shall use the thermal derating of MIL–STD–975, Appendix A. The thermal derating for all other junction devices (i.e. microcircuits and semiconductors) shall be Tj=125 degrees centigrade or Tjmax–20 degrees centigrade, whichever is less. Tjmax is the maximum device junction temperature rating. All other part types (non–junction) require, as a minimum, a 20 degree centigrade margin of derating between the upper worst case thermal stress and the specified maximum thermal rating. A 25 percent derating of mechanical stress levels from the part maximum ratings is required for all part types. The application review shall assure that the part will not be stressed below its lower temperature level as established by part qualification. The contractors' component derating policy to be used for CSSP shall be provided prior to Preliminary Design Review to assure compliance to this requirement.

3.3.1.8 EEE Parts Procurement. An EEE parts procurement control approach that will assure that parts are procured from approved sources, that all applicable requirements are met, and that all parts are acceptable for use in space equipment shall be developed and implemented. A consolidated procurement approach shall be a major consideration for EEE parts control and acquisition. The procurement approach selected shall consider cost, availability, and commonality. Procurement controls shall be developed in accordance with the requirements of SPAR SS–SG–0536. Source evaluation and approval and EEE part physical analysis acceptability shall be documented in accordance with SPAR–SS–SG–0536 and SPAR–SS–PL–0192 .

3.3.1.9 EEE Parts Handling. Procedures which include minimum requirements shall be established and implemented for control of parts storage, stocking, and installation. These controls shall prevent the use of parts that may be in a questionable condition and prevent degradation of parts due to environments, faulty equipment, or manufacturing/assembly techniques. Handling and storage procedures shall assure that susceptible devices are adequately protected from ESD.

3.3.1.10 EEE Parts Identification Data. Identification data shall be provided for all EEE parts. Provisions shall be made to record and retrieve information relating to the specific tests performed, test results, and processes on each lot of parts. Identification of the part number and part manufacturer's name and manufacturer's lot date code and/or serial number for each circuit board assembly shall be available for each part installed in deliverable end items, including qualification and test articles. CSA contractors shall provide this data in the Acceptance Data Package in accordance with DR SSQ–QA–004.

3.3.1.11 EEE Parts Problem Reporting and Corrective Action (PRACA). Problems reported in the PRACA system that are identified as part failures shall be investigated to determine remedial and preventive action. The significance of the failure as related to like parts or materials used elsewhere in the system and the possibility of the occurrence of additional failures shall be determined and documented as part of the problem disposition in accordance with paragraph 4.7.6. Each parts' problem investigation is to include the secondary effects of the failure and assure that other parts have not been damaged or degraded. ALERTs shall be issued where applicable in accordance with paragraph 3.3.3. Summaries of part failures from receiving inspection and in–process assembly through tests prior to component acceptance test shall be provided in accordance with SPAR–SS–PL–0192 . Failed parts will be retained in bonded stores until a decision is made by NASA or CSA relative to a part problem trend.

3.3.1.12 Noncompliant Parts. Use of noncompliant parts requires a waiver or deviation.

3.3.2 MECHANICAL PARTS

A system shall be developed and implemented in accordance with MIL–STD–970 for controlling the parts selection, controlling and renewing parts specifications and applications; controlling and renewing parts procurements and parts manufacturers; conducting part failure analyses; and establishing installation procedures and reliability requirements for mechanical parts to be used in new design hardware. These requirements will be used for assessing the acceptability of off–the–shelf–designs or equipment as far as the identification of required changes during the review prior to the procurement decision.

3.3.2.1 MECHANICAL PARTS SELECTION

Mechanical parts shall be selected on the basis of suitability for their applications and proven qualifications to the requirements of their specifications to the requirements of their specifications. Selection shall minimise the number of styles and generic types.

Approved parts for use are listed in SPAR–SS–SG–0663. Parts proposed for use and not specified in SPAR–SS–SG–0663 are non–standard and require a Non–standard Part Approval Request (NSPAR) in accordance with SPAR–SS–PL–0192. All non–standard parts require NSPAR approval prior to procurement and use. All NSPARs shall be approved by CSA.

3.3.2.2 MECHANICAL PARTS SPECIFICATIONS

All selected parts shall be controlled by specifications in accordance with SPAR–SS–SG–0662.

3.3.2.3 MECHANICAL PARTS LIST

As designed mechanical parts lists shall be developed, submitted and maintained in accordance with SPAR–SS–PL–0192.

3.3.3 REPORTING PARTS AND MATERIALS PROBLEMS AND ASSESSING ALERTS

3.3.3.1 NASA ALERTS. Problems with parts, materials, equipment, or diminishing sources, which are of mutual concern to NASA and associated contractors, shall be reported through the GIDEP ALERT system (DD Form 1938) and general document summary sheets (DD Form 2000). ALERT documentation shall be in accordance with DR SSQ–EEE–007. Generic problems reported through the GIDEP ALERTs by a CSSP contractor or subcontractor shall be approved by the responsible CSA/NASA facility prior to release. Previously published ALERTs will be reviewed to assure that generic problems and technical issues will be avoided. GIDEP distributed ALERTs shall be evaluated and responses provided by a systematic closed loop approach. Where use of an item reported in an ALERT is established for a given unit of hardware, a problem report shall be prepared in accordance with paragraph 4.7.6. Copies of GIDEP indexes and copies of applicable ALERTs will be provided by NASA as required.

3.3.3.2 CSSP Alerts. Problems with parts, materials, equipment, or diminishing sources, which are of mutual concern to the CSA and their contractors, shall be assessed and reported in accordance with the applicable CSSP DR.

4.0 QUALITY ASSURANCE

4.1 MANAGEMENT AND PLANNING

4.1.1 PLANNING

Quality Assurance activities shall be planned and developed to be an integral part of International Space Station Alpha design, development, test and evaluation production, and operational activities and refurbishment/overhaul. Scheduled status reporting will be used to provide visibility and assist in controlling the Quality Assurance effort. Objectives will be to plan and establish the Quality Assurance effort; to define the major Quality Assurance tasks and their place as an integral part of the design and development process; and to assure the effective implementation of Quality Assurance requirements. Quality Assurance program planning shall address all program phases and shall provide a comprehensive management approach to preventing, detecting, documenting, and resolving actual or potential nonconformances.

4.1.2 ORGANIZATION

Organizations and personnel responsible for implementing and performing Quality Assurance functions shall have well defined responsibilities, authority, and organizational freedom to develop and implement Quality Assurance disciplines and controls. One designated person shall have the responsibility and authority for directing and managing the Quality Assurance activity. That person shall have direct unimpeded access to the management level having full responsibility for the program/project work and shall report regularly on the status and effectiveness of quality activities.

4.1.3 QUALITY PROGRAM PLAN

The quality organization shall prepare, implement, and maintain a quality plan which describes the compliance with requirements set forth herein. The plan content shall be readily identifiable with each cited requirement and shall cover all quality activities. Contractor quality procedures which define involvement by the CSA y shall be reviewed and approved by the CSA . New or existing policies and procedures with no CSA involvement shall be available for review. The plan shall serve as the master planning and control document and shall be submitted in accordance with DR SSQ–QA–001. A launch site quality plan shall be prepared for NASA launch sites. This plan’s content shall be defined and agreed upon in coordination with the CSA quality offices and the Launch Site Quality Office.

4.1.4 PLANNING FOR ON–ORBIT ACTIVITIES

A systematic means of evaluating on–orbit activities including assembly, planned and unplanned maintenance, and hardware upgrades shall be developed. This planning shall

identify required inspections, inspection tools, frequency of inspections, calibrations, and associated training. The results of the planning shall be provided as inputs to the on–orbit maintenance operations and logistics plans. The evaluation shall be accomplished and documented at Orbital Replaceable Unit (ORU), maintenance, and assembly levels. Failure causes, failure modes, and criticality identified on the FMEA shall be considered. Data elements and submittal requirements will be in accordance with DR SSQ–QA–002.

4.1.5 MANAGEMENT ASSESSMENT DATA

The contractors quality organization shall provide a quality progress and status report to their respective program management office and/or CSA in accordance with DR SSQ–QA–003.

4.1.6 TRAINING

Quality Assurance shall determine the need for and the adequacy of training courses used in the various Quality Assurance disciplines for submittal to the government for inclusion in the flight crew training program. Included shall be courses for on–orbit verification methods, techniques, and equipment unique to the hardware being developed. Quality Assurance shall also assure development, implementation, and maintenance of a documented training program for special processes. Personnel performing or inspecting special processes shall be trained and certified. Evidence of personnel certification shall be available in the area where duties are being performed. Personnel shall be recertified as a result of unsatisfactory performance, changes in techniques or required skills, and/or extensive interruption of work performance. Records of training, testing, and certification status of personnel shall be maintained and shall be available for review by the applicable procurement agency or its delegated representative.

4.1.7 INTERNAL QUALITY PROGRAM AUDITS AND SURVEYS

Quality Assurance shall conduct audits or surveys of task performance, procedures, and operations which implement the quality program. Assessments shall be conducted periodically as appropriate with program maturity and shall be performed by personnel not having specific line responsibilities in those areas. Each audit or survey shall include an examination of operations and documentation, evaluation of actual operations as compared with each established requirement, documentation of discrepancies and deficiencies, and recommendations for corrective action, as appropriate. A corrective action plan which addresses measures to be taken to correct the discrepancies/deficiencies noted during the survey/audit shall be prepared and approved. Follow–up activities shall include reviews to ensure that measures required by the corrective action plan are being implemented properly. The results of audits and surveys

shall be documented in a report to management. Management action shall be taken to ensure correction of the reported deficiencies. Followup reviews shall be made to ensure that required corrections have been implemented. Records of the contractor's audits and surveys shall be available for review by the CSA or its delegated representative.

4.1.8 MILESTONE REVIEWS

Quality Assurance activities shall include supporting project milestones such as design, acceptance, and readiness reviews. Participation in reviews shall assure that quality requirements are adequately considered in decisions which affect hardware design, configuration controls, initiation of subsystem and integrated testing, shipment, and readiness for flight. Quality Assurance data presented will contain sufficient detail to allow management to assess the acceptability to proceed with the next program phase activity.

4.2 DESIGN AND DEVELOPMENT CONTROLS

4.2.1 TECHNICAL DOCUMENTS

Quality Assurance shall conduct timely reviews of technical documents and changes thereto prior to document release. Designs produced by automated systems shall have an equivalent level of control.

4.2.1.A Quality Assurance shall verify that a documentation system that assures the inclusion of quality characteristics and design criteria in specifications, procedures, drawings, fabrication and inspection planning, and test documents is established and implemented.

4.2.1.B Quality Assurance shall assure that the drawing system and other specifications identify hardware characteristics requiring verification with particular emphasis on critical characteristics. This identification shall be used in developing quality inspection and test verification planning and procedures.

4.2.2 QUALITY SUPPORT TO DESIGN REVIEWS

Quality Assurance shall participate in design reviews to ensure that designs permit and facilitate the quality considerations of producibility, repeatability, inspectability, and refurbishability/maintainability and that other related quality considerations are defined.

These reviews shall reflect the requirements and criteria as defined in the Quality Assurance checklist. Quality Assurance shall define methods and plans for product inspection and test commensurate with the definition of design and fabrication requirements. This technical planning activity shall be integrated into the detailed fabrication and inspection planning. Quality Assurance shall review selected program documents prior to design reviews to ensure compliance with these requirements. Quality participation shall be documented to provide a historical record of quality concurrence in the design development.

4.2.3 CHANGE CONTROL VERIFICATION

Engineering changes shall be reviewed by Quality Assurance to determine the quality impact such as modified inspection/test requirements, identification of new or modified tooling, gauging, or test equipment needs, and identification of changes to critical inspection/test procedures. CSA shall be notified of any proposed changes in fabrication, materials, methods, or processes which may affect the quality or intended end use of an item. Change incorporation shall be verified in accordance with specified effectivity with special attention to changes involving interface relationships.

4.2.4 PRODUCT/PROCESS DEVELOPMENT AND VALIDATION

Quality Assurance shall participate in product and process development activities to ensure that fabrication quality requirements are defined in concert with product requirements. Quality shall assure criteria for material, and process controls are developed consistent with these requirements. Product and process activities include, but are not limited to, development of mockups, engineering models, qualification/protoflight units, development test units, and development of processes and fabrication methods. Commensurate with these activities, Quality Assurance shall develop methods and plans for verification of these requirements with particular emphasis on early identification of critical characteristics.

4.3 IDENTIFICATION AND DATA RETRIEVAL

4.3.1 GENERAL

A documented identification and data retrieval system shall be developed, implemented, and maintained. Each article and material shall be identified by a unique part or type number, and the method shall be specified on engineering drawings and specifications. All disciplines shall use identification numbers related to the engineering design. Criticality, design complexity, application, performance characteristics, manufacturing,

processing or environmental conditions, and limited–life sensitivity shall be used to determine the level of control applied through identification and data retrieval requirements. An identification and data retrieval system shall be provided for parts and materials installed or consumed in ISSA flight elements. This system shall provide visibility to the related manufacturer's lot or batch number and/or date code for parts and materials. An identification and retrieval system shall be developed for part and material locations as follows:

4.3.1.A Each article and material shall be identified by a unique part or type number. One or more of the following detailed identification methods shall be used as applicable:

4.3.1.A.1 Date codes indicating date of manufacture to identify articles or materials made by a continuous and controlled process and those which are subject to variation of degradation with age

4.3.1.A.2 Lot numbers to identify individual materials or articles produced in homogeneous groups

4.3.1.A.3 Serial numbers to identify materials or articles for which unique data are to be maintained

4.3.1.B Other identification methods, such as paint dots, etc., must be approved by the CSA.

4.3.1.C Methods of location of part or type numbers and detailed identification on articles shall be indicated in technical documents.

4.3.1.D Controls shall be included to assure identification numbers are assigned in a consecutive manner.

4.3.1.E Records shall indicate detailed identification and be organized so that records and the related article or material may be located and retrieved as necessary.

4.3.1.F Requirements shall be established for EEE parts which will provide the capability of tracing backwards from fabricated hardware to the lot from which the part originated.

4.3.2 RETENTION OF RECORDS

Records shall be retained in a safe, accessible location for an agreed period . Records shall not be destroyed unless authorized in writing by the CSA contract authority.

4.3.3 RECORD RETRIEVAL

Record systems shall ensure that records are identified and related to the applicable articles and materials. The system shall be organized so that these records and the related articles and materials may be rapidly located and retrieved.

4.4 PROCUREMENT

4.4.1 PROCUREMENT CONTROLS

The contractor is responsible for assuring that purchased articles, materials, and services conform to the requirements specified in this document and other program requirements. Control of procurements shall include identification of contract quality requirements, selection of qualified suppliers, verification of product quality and compliance with contractual requirements, and provisions for reporting and correcting nonconformances.

4.4.2 SELECTION OF CONTRACTOR PROCUREMENT SOURCES

Quality personnel shall participate in the selection of procurement sources based on one of the following:

4.4.2.A The procurement source shall have a previous and continuing record of supplying quality articles, materials, or services of the type being procured.

4.4.2.B A priorate survey of the procurement source facility and quality system shall be conducted in accordance with documented procedures, developed by the procuring organization, to determine if the procurement source is capable of satisfying procurement quality requirements. The results of priorate surveys shall be documented and maintained on file.

4.4.2.C When articles or materials were fabricated specifically for contracts issued under other NASA or Canadian Government contracts that have current acceptable surveys, a priorate survey is not required.

4.4.3 PROCUREMENT DOCUMENTS

Procurement documents shall be written and processed in accordance with the following:

4.4.3.A Prior to release, applicable procurement documents shall be approved by quality personnel to ensure inclusion of appropriate quality requirements and associated documentation.

4.4.3.B Procurement documents shall require each procurement source and its subtier sources to comply with the applicable requirements of this document. The contractor, in complying with these requirements, may use its existing procurement requirements documents subject to approval by CSA prior to implementation. The quality system of suppliers of off–the–shelf hardware shall be reviewed and evaluated to establish the adequacy of their imposed quality system. Items such as historical information, previous quality performance, and compliance with standardized quality systems shall be factors during the course of the review.

4.4.3.C Procurement documents shall contain the following specific requirements:

4.4.3.C.1 Changes. The procurement source shall be required to notify the procuring organization of any proposed changes in fabrication, materials, methods, or processes previously approved and shall obtain written approval from the procuring authority before making the change. When a proprietary item is procured, the procurement source shall be required to notify the procuring organization of changes in materials, fabrication methods, processes, or product operating characteristics prior to delivery.

4.4.3.C.2 Test Results. Records of test results shall be maintained and must be traceable to the procured articles. Purchased raw materials shall be accompanied with chemical and/or physical test results. Procedures shall provide for periodic laboratory analysis and testing to verify the validity of test reports received from suppliers of raw materials.

4.4.3.C.3 Government Source Inspection (GSI) [including inspection by the CSA]. When CSA or its designated representatives elect to perform inspection at a procurement source, the following statement shall be included in the procurement document: ”Work on this order is subject to inspection and test by CSA or its designated representatives at any time and place and in accordance with CSA rules and regulations.

4.4.3.C.4 Procurements Other Than Those Requiring GSI. CSSP procurements which do not require source inspection, shall include statements allowing right of access and inspection in accordance with the CSA rules and regulations.

4.4.4 REVIEW OF PROCUREMENT DOCUMENTS

The contractor procuring organization shall submit the procurement documents to the designated CSA quality representative for determination of the need for GSI prior to release of the procurement. Source inspection performed by and for the convenience of CSA shall not replace contractor source inspection nor relieve the contractor of the responsibilities for ensuring product quality.

4.4.5 CSA QUALITY ASSURANCE PERSONNEL AT SOURCE

CSA shall assign Quality Assurance personnel at contractor facilities based on the criticality and complexity of the equipment, experience with the source, when testing or critical inspections cannot be accomplished by the CSA, or when articles or materials are designated for direct shipment from the source to a CSA designated center, or the using site. CSA shall provide written instructions for its source personnel which will include a requirement to record the history and results of source activities in the following areas: general information, system control, product control, and process control.

4.4.6 RECEIVING INSPECTION

Quality Assurance shall develop, implement, and maintain a documented receiving inspection activity to ensure that procured articles comply with procurement document requirements, inspection and test data are accurate and acceptable, evidence of contractor and CSA source inspection has been provided as required, specified identification and data retrieval requirements have been met, time/cycle–sensitive articles are identified, expended and remaining time/cycle information is complete, chemical analyses and physical tests are performed, and receiving inspection results and status of articles are maintained. Procedures shall provide for periodic laboratory analysis and testing to verify the validity of test reports received from suppliers.

4.4.7 PROCUREMENT SOURCE DATA

Inspections and test results commencing with receiving inspection shall be recorded to reflect, on a continuous basis, the qualitative and quantitative performance of individual sources and the quality histories of the supplied articles and materials. Quality Assurance shall maintain data to aid in the selection of procurement sources, establish trends of potential problems, and initiate action to resolve any negative trends.

4.4.8 AUDITS AND SURVEYS OF PROCUREMENT SOURCE OPERATIONS

The contractor shall schedule and conduct audits and surveys of procurement sources in accordance with SSP 30521 and based upon the following:

4.4.8.A Type of items being procured; e.g., criticality or complexity of article or material or special processes involved

4.4.8.B Procurement source quality history including known problems or difficulties

4.4.8.C Remaining period of procurement source performance For planning purposes, a schedule shall be prepared and shall include all planned audits and surveys for at least one year in advance and shall be amended to accommodate unanticipated problem areas. The schedule shall be maintained throughout the duration of the procurement and shall be available for review.

The audits and surveys shall be to evaluate the quality system, including implementing policies and procedures, and shall be performed in accordance with documented procedures and checklists which are based on program requirements. Audits and surveys results shall be documented and follow up action shall be taken to ensure deficiencies have been corrected within the specified period of time.

CSA and/or their major contractor shall participate in a joint audit or survey program with other effected centers and contractors to minimize the number of audit and surveys performed at common procurement sources.

4.5 FABRICATION CONTROLS

4.5.1 FABRICATION OPERATIONS

Quality shall support fabrication operations, including assembly and test, to ensure that critical characteristics of the design are identified and their conformance to engineering specifications is maintained in all articles produced. Critical characteristics shall be selected by quality, manufacturing, and engineering personnel and shall be derived from drawings, specifications, FMEAs, CIL, Hazard Analysis, etc. Critical characteristics shall be designated as inspection points that must be verified by Quality Assurance personnel. Identification of these characteristics, definition of methods, and sequence of operation shall be consistent with the criteria, methods, and plans developed during product development and reviewed at design reviews. Detailed fabrication and inspection

planning shall be available for procurement agency review prior to fabrication and shall contain the following as a minimum:

4.5.1.A Nomenclature and identification of the article to be fabricated

4.5.1.B Drawings and specifications required

4.5.1.C Tooling, jigs, fixtures, and other fabrication equipment to be utilized

4.5.1.D Detailed instructions for fabrication and assembly of articles

4.5.1.E Characteristics and tolerances to be obtained

4.5.1.F Detailed procedures for controlling processes and cleaning, preservation, and packaging operations

4.5.1.G Special conditions to be maintained such as environmental controls, specific cleanliness levels, and precautions to be observed

4.5.1.H Workmanship standards if applicable

4.5.1.I Specific inspections and/or test operations to be performed during fabrication to provide verification of design characteristics

4.5.1.J Special handling equipment and protective devices [e.g. Electrostatic Discharge (ESD) Control]

4.5.1.K Traceability to the individual performing the operation and to the inspection personnel verifying compliance

4.5.1.L Traceability to the CIL where applicable

4.5.1.M Configuration data, including parts lists, drawings, changes, specifications, and identification data, to ensure fabrication to the proper design requirements. If quality designees (reference paragraph 4.5.8) are used, the operations to be performed by such personnel shall be strictly identified. When CSA has specified source inspection, the planning shall be coordinated with the CSA or its delegated representative for inclusion of mandatory inspection points.

4.5.2 ARTICLE AND MATERIAL CONTROLS

The following controls shall ensure that only conforming articles and materials are accepted and used:

4.5.2.A Data shall be maintained for articles identified as having characteristics of quality degradation or drift with age and/or use. The date, time, or cycle from which useful life is calculated; the date, time, or cycle at which the useful life will be expended; and the incurred operating time or cycles shall be recorded.

4.5.2.B Quality Assurance shall verify that requirements for articles and materials to be fabricated, processed, inspected, or tested in a temperature, humidity, ESD, or contamination controlled environment are properly implemented.

4.5.2.C Quality Assurance shall verify, prior to initial use and at established intervals thereafter, the accuracy of production jigs, fixtures, tooling masters, templates, patterns, and other devices used for inspection.

4.5.3 CLEANLINESS/CONTAMINATION CONTROL

Quality Assurance shall assure that contaminant–sensitive items are cleaned and controlled in accordance with documented procedures to the levels specified in the applicable technical documents and are maintained to these cleanliness levels. These procedures shall cover hardware, equipment, personnel, and control of such areas as fabrication, assembly, inspection, test, and storage. Specific cleanliness levels to be maintained for systems, subsystems, and major components shall be indicated on drawings, specifications, or other documents controlling the manufacture and test of those items. Quality Assurance shall assure that clean–room disciplines and procedures are properly implemented and monitored to assure continuing compliance with requirements.

4.5.4 PROCESS CONTROLS

Quality Assurance shall implement controls for those processes where uniform, high quality cannot be assured by inspection of articles alone. The requirements for materials

and processes are contained in SPAR–SS–SG–0089, Materials and Processes Requirements Definition Document, SPAR–SS–PL–0383 Space Station Materials and Processes selection, Control and Verification plan and SPAR–SS–PP–0095 Product Assurance Plan Space Station MSS. These processes include, but are not limited to, metallurgical and chemical processes, soldering, welding, potting, bonding processes, plating and coating processes, and surface treating processes. These controls shall assure that special processes are performed by certified personnel; that facilities, equipment, materials, and procedures are adequate, maintained, and properly used; and that records are controlled. An up–to–date listing shall be maintained of all process control procedures and process specifications used in the fabrication, control, and inspection of the materials and articles. Contractor process specifications shall be available for review by CSA or its delegated representative. The contractor shall also furnish similar information from the subcontractors upon request. Requirements for disclosure of contractor and subcontractor proprietary process specifications shall be established with CSA on an individual basis.

4.5.5 NONDESTRUCTIVE EVALUATION (NDE)

NDE methods shall be used, as required, and controlled to ensure quality hardware. NDE standards shall be used or prepared based on hardware configurations and geometry. Quantitative acceptance or rejection criteria shall be established for each NDE application. Personnel performing non–destructive evaluation processes shall be trained and certified.

4.5.6 WORKMANSHIP STANDARDS

Workmanship standards shall be employed throughout all phases of hardware manufacture to control the quality of the operation. These standards must comply with NASA NHB 5300.4 series or CSA approved contractor equivalent. Samples or visual aids required to verify acceptable workmanship shall be subject to review by the CSA designated quality representative. Standards shall identify specific acceptance/rejection criteria.

4.5.7 CONTROL OF TEMPORARY INSTALLATIONS AND REMOVALS

Quality Assurance shall maintain a log or otherwise ensure the management and control of articles or components that are temporarily installed or removed to facilitate manufacturing, testing, shipping, or handling of the Contract End Item (CEI). The control shall be initiated upon installation or removal of the first temporarily installed or removed item and shall be maintained through delivery and use of the equipment. Temporarily installed items shall be uniquely identified to prevent them from becoming a part of the final configuration.

4.5.8 QUALITY ASSURANCE DESIGNEES

A systematic approach may be developed to designate certain trained and qualified manufacturing and test personnel to represent Quality Assurance in performing selected inspection and test functions. The approach shall be described in the Quality Plan. The selected inspection and test functions shall exclude those processes, inspections, and tests that are required to verify critical characteristics or where reinspection cannot be readily accomplished due to further assembly or installation of hardware.

4.5.9 INSPECTION PROCEDURES

Where inspection operations are complex and difficult to perform, Quality Assurance shall assure the preparation of specifically planned procedures to assure accuracy and validity of data and supplement the normal fabrication and inspection planning. These procedures shall be formally controlled and shall be based on current design information.

4.6 TEST CONTROLS

4.6.1 VERIFICATION

Quality Assurance shall verify tests that demonstrate program, contract, drawing, and specification requirements have been met on all articles and materials procured and produced. Quality Assurance approval of test results shall be provided to show that the quality inherent in the design is maintained in the articles produced. Quality Assurance shall review the test or verification plan to ensure inclusion of pertinent quality requirements.

4.6.2 TEST PROCEDURES

Approved test procedures shall be readily available to inspection and test personnel at the applicable location at the time of inspection or test. Quality Assurance shall assure that test procedures include the following information:

4.6.2.A Nomenclature and identification of the test article or material

4.6.2.B Characteristics and design criteria including values and tolerances for acceptance and rejection

4.6.2.C Identification of characteristics and design criteria specified for verification

4.6.2.D Detailed steps and operations to be taken in sequence including verifications to be made before proceeding

4.6.2.E Identification of measuring or NDE equipment to be used specifying range and type

4.6.2.F Details or instructions for operation of special data recording equipment

4.6.2.G Layout of interconnection of test equipment and articles

4.6.2.H Identification of hazardous situations or operations

4.6.2.I Precautions to comply with established safety requirements, ensure safety of personnel, and to prevent damage or degradation of articles and measuring equipment

4.6.2.J Environments and other conditions to be maintained

4.6.2.K Identification of any reference drawings, specifications, workmanship standards and/or other reference documents required to enable full comprehension of test requirements

4.6.2.L Constraints on inspection or testing

4.6.2.M Special instructions for nonconformances, anomalous occurrences, or results

4.6.2.N Details of sampling plans used

4.6.2.O Details of NDEs

4.6.2.P Identification of steps that involve critical items or requirements

4.6.2.Q Configuration/revision level of hardware/software used during test

4.6.3 TEST PERFORMANCE

Quality Assurance shall assure that tests are performed in accordance with approved procedures and that any deviations to the test procedures are properly recorded and approved. Each test operation shall be traceable to the individual responsible for its accomplishment. Articles undergoing test shall not be adjusted, modified, repaired, reworked, or replaced except as authorized by properly approved documents. Quality Assurance test verification shall include the following:

4.6.3.A Prior to testing, Quality Assurance shall verify that approved test procedures are available, that test equipment is calibrated and properly configured, that the facility is properly configured, that all manufacturing and lower level test operations are complete, and that the configuration of the article is correct and ready for test.

4.6.3.B During testing, Quality Assurance shall verify that testing is performed in accordance with approved test procedures or that procedure deviations are recorded, that test data are accurately recorded, and that all nonconformances are documented.

4.6.3.C Subsequent to testing, Quality Assurance shall verify that test results and data are complete and traceable to the test articles, that proper dispositions of articles have been made, that nonconformances are documented, that remedial action and recurrence control requirements are initiated and that integrity control of test articles is properly established and implemented.

4.6.3.D Documentation shall include procedures for the development, verification and control of computer software/firmware used in conjunction with measurement and test equipment for acceptance of articles.

4.6.4 INSPECTION AND TEST RECORDS AND DATA

4.6.4.1 Records. Records and data of all inspections and tests performed shall be prepared and maintained in sufficient detail to verify and evaluate the status of articles and materials.

4.6.4.2 End–Item Acceptance Data Package (ADP). Quality Assurance shall prepare and maintain an ADP for each end item as specified in DR SSQ–QA–004.

4.6.4.3 End–Item Acceptance Review (AR). Quality Assurance shall participate in ARs to assure compliance with documentation requirements. The following information shall be available for review at the end–item AR:

4.6.4.3.A A summary of test and checkout operations and results with discussion of anomalies encountered, failure history, remedial actions, and recurrence control

4.6.4.3.B The status of any open work, including open items from previous reviews, shortages, nonconformances, unincorporated engineering changes, etc., and constraints on further activities

4.6.4.3.C Identification of waivers/deviations and verifications of approval

4.6.4.3.D Identification of limited life components and their remaining life

4.6.4.3.E A comparison of as–designed versus as–built configuration listings and rationale for any differences from approved baseline designs

4.6.4.3.F The test procedure and test data for all end item acceptance tests including strip charts, deviations, and other data applicable to evaluate test records

4.6.4.3.G Completed deliverable end–item data package(s)

4.6.4.3.H A form DD250 (or equivalent CSA acceptance documentation) prepared for signature

4.6.4.3.I Records of all nonconformances occurring during manufacturing and test of end–item

4.6.4.3.J Handling, shipping, storage, preservation, packing, and packaging instructions, including environmental constraints, identification of hazards, and maintenance requirements and user manuals

In addition, all supporting documentation, which may be required to establish equipment acceptability, should be readily retrievable. This includes, but is not limited to, engineering drawings, schematics, supplier ADPs, test specifications, fabrication and inspection test records, etc.

4.7 NONCONFORMING ARTICLES AND MATERIALS

4.7.1 NONCONFORMANCE CONTROL SYSTEM

Quality Assurance shall establish, implement, and maintain a documented closed–loop system for controlling nonconformances. This system shall include provisions for recording, analysis, remedial action, recurrence control, verification, and feedback of data on articles and materials which do not conform to drawings, specifications, or other requirements. Special emphasis shall be placed on tracking and resolving repetitive nonconformances. The procuring organization (CSA/Contractor) shall assure that subcontractors and suppliers implement a closed–loop system which complies with the requirements of this paragraph.

4.7.2 IDENTIFICATION OF NONCONFORMANCES

Nonconformances shall be documented in accordance with DR SSQ–QA–005. Nonconformance recording shall commence with initial receipt of materials or articles for CSSP procurement and continue through all subsequent phases of the program. Nonconforming articles or materials shall be identified, segregated to the extent practicable, and held for disposition.

4.7.3 NONCONFORMANCE EVALUATION

Appropriate analysis and examination of nonconforming articles, materials, or conditions shall be conducted to determine the cause or reason for the nonconformance and to recommend further action.

4.7.4 NONCONFORMANCE DISPOSITIONS

The contractor may disposition nonconforming articles or materials without the participation of CSA or their delegated representatives as follows:

4.7.4.A Return to Supplier. When, on receipt, an article or material is found to be nonconforming, it should be returned to the supplier. The contractor shall provide the supplier with sufficient nonconformance information to allow correction of the defect and development of corrective action to preclude recurrence.

4.7.4.B Return for Rework or Completion of Operations. Rework or completion of operations shall be performed using established fabrication, inspection, and test documents.

4.7.4.C Scrap. If the article or material is unfit for use, its disposition shall be assigned in accordance with approved CSSP procedures for identifying, controlling, and disposing of scrap.

4.7.4.D Material Review Board (MRB). All other nonconformances shall be submitted to the MRB for final disposition.

4.7.4.1 Nonconformance dispositions referred to in paragraphs 4.7.4.A thru 4.7.4.C shall be subject to review by the designated CSA quality representative.

4.7.5 CSSP MATERIAL REVIEW BOARD (MRB) ACTION

MRB membership and the disposition and control of affected hardware shall be based on the following:

4.7.5.A The MRB shall be comprised of at least one representative whose primary responsibility is engineering, a designated contractor product assurance/quality assurance representative, and a CSA designated quality representative . The contractor product assurance/quality assurance representative shall act as chair of the MRB. MRB members may consult with other organizations and personnel, as required, to arrive at optimum decisions.

4.7.5.B Dispositions of nonconformances by the MRB require unanimous agreement. Decisions shall be based on intended use and criticality of the hardware; record review of earlier actions, materials, and techniques used for repair; and retest requirements necessary to revalidate functional acceptability. The board shall make one of the following dispositions and specify the action in the nonconformance document:

4.7.5.B.1 Repair. Repairs shall be made according to approved Standard Repair Procedures (SRP)s. When an acceptable repair cannot be performed in accordance with an MRB–approved SRP, specific repair instructions shall be documented on the nonconformance record and approved by the MRB prior to the repair activity. The MRB has sole authority for final approval and revision of SRPs. Limitations for use shall be specified on each SRP. The existence of standard repair procedures shall not relieve the contractor of the responsibility for initiating preventive action to the fullest extent.

4.7.5.B.2 Use As Is. Nonconforming items which the MRB dispositions as suitable for use without repair may be authorized for use as is. The technical rationale for making a use–as–is disposition shall be documented on the nonconformance report.

4.7.5.B.3 Scrap. If the article or material is unfit for use, its disposition shall be assigned in accordance with approved CSSP procedures for identifying, controlling, and disposing of scrap.

4.7.5.B.4 Waivers. When the disposition affects program requirements, appropriate CSA approval shall be required. Contractor waivers shall be submitted to the CSA contracting officer for approval. Each waiver request shall include CSA Quality Assurance representative remarks to facilitate proper consideration of the waiver and assure correct category. Each waiver shall be submitted in accordance with DR SSQ–QA–006.

4.7.5.B.5 Articles or Materials Returned to Source. Nonconforming articles or materials returned to the source and subsequently resubmitted to the customer shall bear adequate identification of such resubmission. Reference shall be made to the nonconformance document, and evidence that remedial and recurrence control actions have been taken shall be provided. Immediately upon receipt of the returned article or material, the source and/or the customer shall ensure that the designated CSA quality representative is notified.

4.7.5.C MRB Holding Area. Holding areas shall be established for nonconforming articles and materials pending MRB disposition. Access shall be limited to MRB members or personnel authorized by the MRB. Provisions shall be made to prevent unauthorized removal of hardware.

4.7.5.D Supplier MRB. The contractor may delegate MRB responsibility to a supplier upon determining that the supplier meets the MRB requirements of this document. This delegation shall be approved by the CSA or its designated quality representative.

4.7.5.E Recurrence Control. Quality Assurance shall assure the evaluation of all nonconformances to determine cause and action required to preclude recurrence. Evidence of such action shall be documented on each nonconformance report prior to closeout. Recurrence control shall include, but shall not be limited to, correction of technical documents and correction of other articles and materials at all locations.

4.7.6 PROBLEM REPORTING

A closed–loop system shall be provided for reporting and correcting problems. All problems involving flight articles, flight–like articles, and GSE shall be included in this system. Detailed requirements for problem reporting, analysis, and resolution shall be in accordance with DR SSQ–QA–007 and SSP 30223, Problem Reporting and Corrective Action (PRACA) System Requirements for the Space Station Program or the CSSP document that meets or exceeds SSP 30223.

4.8 METROLOGY

4.8.1 METROLOGY CONTROLS

A documented metrology system shall be established and maintained to ensure that measurement standards and equipment provide objective evidence that articles and materials produced or procured are in compliance with specifications, drawings, and program and contractual requirements. All new or repaired measurement standards and equipment shall be inspected and/or tested prior to use. Documentation of this effort shall be maintained and made available for review by the designated CSA quality representative.

4.8.2 CALIBRATION RECORDS

Individual records of measurement standards and equipment calibration shall be maintained. These records shall include, but are not limited to, the following:

4.8.2.A Identification of standard or equipment to be calibrated

4.8.2.B Identification of standard equipment and calibration procedure used in the calibration process

4.8.2.C Calibration intervals

4.8.2.D Dates and results of each calibration

4.8.2.E Due date of next calibration

4.8.2.F Individual(s) performing calibration

4.8.2.G Calibration facility

4.8.2.H Degree of nonconformance of standards or equipment received for calibration

4.8.3 MEASUREMENT ACCURACY

Random and systematic errors in any article or material measurement shall not exceed ten percent of the tolerance of the article or material characteristic being measured. Authorization for exception shall be requested from the CSA. Random and systematic errors in any calibration measurement shall not exceed 25 percent of the tolerance of the parameter being measured. Authorization for exception shall be requested from the CSA.

4.8.4 CALIBRATION CONTROLS

4.8.4.1 Facility. Each organization shall have its own facility for calibrating measurement standards and equipment or shall use the services of an outside facility which meets the requirements of this paragraph.

4.8.4.2 Traceability. All measurement standards shall be traceable to standards maintained by the National Institute of Standards and Technology (NIST), the National Research Council of Canada (NRC) or their values shall be derived from a controlled measurement process utilizing a fundamental constant of nature.

4.8.4.3 Handling, Storage, and Transportation. All measurement standards and equipment shall be handled, stored, and transported in accordance with documented procedures which shall preclude equipment damage or degradation of accuracy.

4.8.4.4 Identification and Labelling. All measurement standards and equipment shall be uniquely identified and labelled, tagged, or coded to indicate calibration status and due date of next calibration.

4.8.4.5 Calibration Intervals. Calibration intervals shall be established, documented, and periodically reviewed. Intervals shall depend upon the use, accuracy, type of standard or equipment, and other conditions affecting the measurement process.

4.8.4.6 Recall System. All standards and equipment used in measurement processes shall be recalled and recalibrated at established intervals. Standards and equipment not recalibrated on or before the recall due date or damaged in use shall be removed from service or otherwise restricted from use. Authorization for exception shall be obtained from the CSA.

4.8.4.7 Environmental Requirements. Environmental conditions (i.e., temperature, humidity, vibration, cleanliness) shall be compatible with the requirements of the article and material and calibration measurement processes.

4.8.5 REMEDIAL ACTION AND RECURRENCE CONTROL

Recurrence control shall be taken relative to nonconforming measurement standards or equipment and shall extend to the articles or materials previously measured using such equipment.

4.9 STAMP CONTROLS

Quality Assurance shall establish and maintain a documented stamp control system with procedures that provide for the following:

4.9.A STAMP AND MARKING MATERIALS

Stamps, decals, seals, torque wax, paints, signatures, and other marking devices or materials shall be used, as appropriate, to identify that articles and materials have undergone source and receiving inspection; in–process fabrication and inspection; end–item fabrication and inspection; and end–item testing, storage, and shipment.

4.9.B STAMP TRACEABILITY

Stamps shall be traceable to individuals responsible for their use, and records shall be maintained to identify individuals with specific stamps. Unissued stamps shall be kept secure to prevent unauthorized use. Stamps issued to personnel being transferred or terminated shall be returned and shall not be reissued for a period of at least six months.

Worn or damaged stamps shall be destroyed at the time replacements are issued. The identification symbols (e.g., numbers and letters) of lost stamps shall be withdrawn from use. The use of any stamp by an individual other than the holder of record is specifically prohibited. Periodic checks shall be made to assure that stamps are in possession of the individual to whom they are issued and that they are not worn or damaged.

4.9.C STAMP APPLICATION

Stamps shall be applied to records to indicate the fabrication or inspection status of associated articles and materials.

4.9.D ELECTRONIC DATA CONTROL

Verification/validation/acceptance requirements for computerized data entry and retrieval systems and computer generated drawings and documents shall address alternatives to stamp use for certification.

4.9.E STAMPING/MARKING APPLICATION

Stamps shall be applied to tags, cards, or labels or attached to individual articles and materials or their containers as appropriate.

4.9.F STATUS STAMPING

Stamps indicating that fabrication, inspection, or test operations have been performed may be applied directly to articles and materials.

4.9.G STAMPING METHODS

Stamping methods and marking materials must be compatible with the articles and their use.

4.9.H STAMP SIGNIFICANCE

An up–to–date description and explanation of the significance of all stamps shall be maintained.

4.9.I CONTRACTOR STAMP DESIGNS

The design of contractors' stamps shall be such that fabrication and inspection stamps are distinctly different. Contractor stamps shall not exhibit the designation "NASA or CSA," abbreviations of any NASA or CSA installation, or the designation or abbreviations of the Canadian government.

4.10 HANDLING, STORAGE, PRESERVATION, MARKING, LABELLING, PACKAGING, PACKING, AND SHIPPING

4.10.1 PROCEDURES AND INSTRUCTIONS CONTROL

Quality Assurance shall concur, prior to their release, in the controls for handling, storage, preservation, marking, labelling, packaging, and shipping operations.

Effective implementation of these documents shall be assured through controls monitored by Quality Assurance in accordance with approved documentation.

4.10.2 HANDLING

Handling, hoisting, or lifting equipment (e.g. slings) shall be prominently marked to indicate the maximum load capacity and the due date of the next rated or periodic load test. Quality Assurance personnel will verify that the required tests and maintenance are accomplished within the specified frequency.

4.10.3 STORAGE

Storage areas for articles and materials shall be controlled. The controls shall include the following:

4.10.3.A Controlled acceptance into and withdrawal from the storage area

4.10.3.B Positive identification of limited–life material and removal of materials with expired shelf life

4.10.3.C Periodic inspection of stored material, housekeeping, and recordkeeping

4.10.3.D Systematic inspection and/or testing necessary to ensure maintenance of preservation including special environments

4.10.4 PRESERVATION

Quality Assurance shall verify that articles and materials subject to deterioration, corrosion, or contamination are preserved by documented methods which ensure adequate protection.

4.10.5 PACKAGING AND PACKING

Quality Assurance shall verify that packaging and packing material, procedures, and instructions are used and that they provide for protection of articles and materials before shipment, during transportation, and after arrival at the destination. Special attention shall be directed toward critical, sensitive, dangerous, and high–value articles. Reusable containers shall be inspected prior to each use.

4.10.6 MARKING AND LABELLING

Quality Assurance shall verify that marking and labelling for packaging, storage, and shipping of articles and materials are performed in accordance with applicable specifications. This marking and labelling shall include such information as complete article or material identification, cleanliness level, environmental requirements, packaging orientation arrows, Caution and Warning (C&W) notes, life–expiration dates, location of data package, and transportation as applicable. Special attention shall be given to critical, sensitive, dangerous, and high–value articles.

4.10.7 SHIPPING

4.10.7.1 CONTROL. QUALITY ASSURANCE SHALL VERIFY THE FOLLOWING:

4.10.7.1.A Articles and materials have been prepared and packaged in accordance with applicable procedures and requirements and have been properly identified and marked.

4.10.7.1.B Accompanying documents have been properly identified as to inspection status by appropriate inspection stamps and the data package is complete.

4.10.7.2 Unscheduled Removal. The contractor shall notify the designated CSA quality representative in the event of any unscheduled removal of an article or material from its container. The extent of reinspection and retest shall be authorized by CSA quality representative.

4.11 SAMPLING PLANS, STATISTICAL PLANNING, AND ANALYSES

4.11.1 SAMPLING PLANS

Sampling plans may be used when inspection tests are destructive or when data, inherent characteristics, or the noncritical application of an article or material indicates that a reduction in inspection or testing will not jeopardize quality, reliability, or design intent. When sampling techniques are to be employed, MIL–STD–105D, Sampling Procedures and Tables for Inspection by Attributes, or MIL–STD–414, Sampling Procedures and Tables for Inspection by Variables for Percent Defective, whichever is appropriate, shall be used. Sampling plans, other than those contained in MIL–STD–105D and MIL–STD–414, may be used after approval by the designated CSA quality representative.

4.11.2 STATISTICAL ANALYSES

Statistical analysis techniques may be used where such use will provide effective control over fabrication and inspection operations especially in those areas where special processes and equipment are difficult to control.

4.12 CONTROL OF NASA AND CSA PROPERTY

4.12.1 CONTRACTOR RESPONSIBILITY

Contractor Quality Assurance shall ensure that a documented system for controlling NASA and CSA property and associated documentation has been established and is maintained as follows:

4.12.1.A Upon receipt, contractor Quality Assurance shall inspect NASA and CSA property to detect damage in transit and to verify that the article and its ADP are complete and as specified in the shipping documents. Articles found to be serviceable shall be represerved and repackaged unless the articles are to be used immediately. Should there be evidence of damage in transit, the article shall be inspected to determine the extent of damage and a report of the damage provided to the designated NASA or CSA representative. Receiving inspection results shall be recorded in the historical record for the article.

4.12.1.B When functional testing is performed on NASA and CSA property during receiving inspection or prior to installation into the next level of assembly, the designated NASA or CSA representative shall be notified and may participate in the testing activity.

4.12.1.C Documented procedures shall describe the control of approved storage areas for NASA or CSA property. Controls shall include the following:

1) Limited personnel access
2) Controlled receipt and withdrawal
3) Identification of article status
4) Inventory list of articles in the area
5) Scheduled inspection of the area and periodic verification of the inventory list
6) Controls for items that must be environmentally protected

4.12.1.D The contractor shall provide for the protection, maintenance, calibration, periodic inspection, segregation, and controls necessary to ensure that quality of NASA and/or CSA property is maintained and that damage and deterioration do not occur during handling, storage, installation, or shipment.

4.12.1.E NASA and/or CSA property shall not be diverted or loaned from its assigned purpose without the prior approval of the designated NASA or CSA representative.

4.12.2 UNSUITABLE NASA OR CSA PROPERTY

NASA and/or CSA property found to be damaged or otherwise unsuitable for its intended use shall be identified as nonconforming, segregated to the extent practicable, held for review, and analyzed to ascertain the probable cause of damage. When the cause is determined to be in the contractor’s operations or activities, action shall be taken to prevent recurrence. Disposition shall not be assigned to discrepant NASA or CSA property nor shall this property be reworked, repaired, modified, or replaced without the specific written authorization of NASA or the appropriate CSA representative. NOTE: Paragraph 4.7.6 may apply.

5.0 SOFTWARE PRODUCT ASSURANCE (SPA)

CSSP product assurance requirements for hardware and operational procedures are addressed only as they relate to software. SSP 41167, MSS Segment Specification Requirements and other paragraphs of this document provide requirements for system aspects of overall system safety, reliability, maintainability, and quality assurance which include software as part of the system components and are not repeated here. SPA activities shall be conducted throughout all phases of the software life–cycle to ensure compliance with CSSP requirements. SPA activities, including procedures, processes, and products shall be documented. Implementation instructions shall be provided for the requirements contained herein. SPA activities are subject to review by the CSA and may be disapproved by CSA whenever CSSP requirements are not met. SPA requirements shall apply to all CSSP operational software products including flight software, flight support software, firmware, and software used in the development, verification, validation, testing, storage and maintenance of operational software. SPA requirements shall apply to Ground Support Equipment (GSE) software associated with critical systems, software which will interact directly with flight or control center hardware and software, and test and verification software, including models and simulations. SPA activities shall focus on all aspects of the development of deliverable software products that may impact system safety, reliability, maintainability, or quality to the extent necessary to ensure CSSP requirements are met. SPA activities shall emphasize the use of preventive as well as corrective methods to assure compliance with CSSP requirements.

5.1 MANAGEMENT

Software product assurance activities shall be planned, managed, and integrated in conjunction with other management and technical functions to assure a complete, concise, and consistent approach to the development of program plans and compliance with CSSP program requirements.

5.1.1 ORGANIZATION

SPA accountability shall be independent of the development organization. Personnel responsible for ensuring compliance with SPA requirements shall have the resources, responsibility, authority, and organizational freedom to permit objective evaluations. SPA shall have the authority to initiate the corrective action process and to verify corrective actions. SPA management shall be structured to provide planning, management, and implementation of all SPA activities. While the accomplishment of all SPA tasks may not be the responsibility of a single organizational element, management of the SPA activities shall be coordinated with project management to ensure that all SPA requirements are assigned to the appropriate organization. Managers of all SPA functions shall have direct access to and shall report status and issues to project management. Persons evaluating a

product or activity shall be persons other than those who develop the product, perform the activity, or who are responsible for the product or activity. This does not preclude members of the development team from participating in these evaluations.

5.1.2 SOFTWARE PRODUCT ASSURANCE PLANNING

SPA activities shall be planned and implemented throughout the software life–cycle. The contractor and the software developer shall prepare and maintain SPA plans in accordance with DR SSQ–SPA–001. The plan shall describe assurance activities during each life–cycle phase. SPA plans shall include an explanation of how tools, rules and procedures will be used to accomplish SPA activities. The preparation of SPA plans and other development plans shall be coordinated to assure an integrated approach.

5.1.3 FORMAL AND INTERNAL REVIEWS

SPA shall participate in formal program, project, and software reviews to evaluate and report on compliance with CSSP requirements. SPA shall have the option to participate in all reviews. Through participation in reviews, SPA shall assure that higher level requirements have been considered in decisions which affect detailed software requirements, software design, configuration controls, CSCI testing, integration testing, acceptance, and readiness for flight. SPA shall evaluate software data presented to support management in assessing whether or not to proceed with the next program phase.

5.1.4 SUBTIER REQUIREMENTS

SPA shall assure that the requirements of this section , are flowed down and adhered to by the contractor, subcontractors, and other subtier providers of software. Direction and control shall be provided to assure that SPA requirements are properly implemented.

5.1.5 NONDEVELOPMENTAL SOFTWARE

SPA shall evaluate each item of nondevelopmental software to be incorporated into deliverable software to assure that:

a) Objective evidence exists, prior to its incorporation, that it performs its required functions
b) It is placed under contractor internal configuration management control prior to its incorporation into the developmental configuration
c) The data rights provisions are consistent with contractual and program requirements.

5.1.6 NASA OR CSA FURNISHED EQUIPMENT (GFE)

When software, related hardware, and documentation are furnished as GFE, the accompanying Acceptance Data Package (ADP) shall be reviewed. If it is determined

that the GFE does not provide functionality or performance consistent with its documented requirements or the GFE is not consistent with the ADP, SPA shall ensure that CSA is promptly and formally notified.

5.1.7 PROGRESS REPORTING

SPA activities shall be reported through management meetings and status reports.

5.1.8 CONTROL BOARDS

SPA shall participate as members on control boards and other boards to assure changes are processed in accordance with approved plans and procedures and to assure that safety, reliability, maintainability, and quality requirements are met.

5.1.9 OPERATIONS AND MAINTENANCE

SPA shall assure that a process is established for the planning and evaluation of software operation and sustaining engineering activities. The process shall ensure the retention of safety, reliability, maintainability, and quality attributes and that changes will not adversely affect the required system fault tolerance.

5.1.10 TRAINING

SPA personnel shall have the training and qualifications commensurate with job responsibilities.

5.1.11 SOFTWARE TOOLS

SPA shall ensure software tools used in the development, verification and validation, integration and test of deliverable software products (such as compilers and code checkers) are placed under configuration control prior to use, are maintained to an approved configuration, and operate consistent with approved changes following any modification or update.

5.1.12 SOFTWARE PRODUCT ASSURANCE RECORDS

SPA shall implement a system to identify, control and status SPA records generated as a result of the performance of SPA activities throughout the software life–cycle. SPA records shall be retained in a safe, accessible location for a period specified by CSA.

5.2 SOFTWARE QUALITY ASSURANCE

SPA shall conduct evaluations of the software life–cycle and the resulting software and associated documentation to assure compliance with CSSP requirements and applicable software development plans. SPA shall assure that: standards and procedural controls are established and implemented; audits, evaluations, and reviews are accomplished; procedures are followed; and all assurance activities are performed as scheduled. Upon SPA approval of a process, any change to that process shall require SPA reevaluation and reapproval.

5.2.1 AUDITS

SPA shall establish a plan and process to audit all activities conducted as part of the software life–cycle. Audits on activities such as development, documentation, testing, configuration management, nonconformance reporting and corrective action activities shall be conducted on a scheduled and unscheduled basis in accordance with SSP 30521. SPA shall verify compliance with approved standards and procedures for these activities.

5.2.2 TOOLS, TECHNIQUES, AND METHODOLOGIES

SPA shall assure that software tools used in the development, verification and validation, integration and test of deliverable software products are evaluated and that objective evidence exists that the tools perform their required functions. SPA shall participate in the identification and assessment of software development techniques and methodologies that facilitate the development of safe, reliable, maintainable, and quality software products.

5.2.3 SOFTWARE DOCUMENTATION

SPA shall ensure software documentation reviews are conducted throughout the software and acquisition life cycle. SPA shall review software documentation to ensure compliance with CSSP documentation standards and applicable contractual requirements. SPA shall review software acquisition documentation to ensure software product assurance requirements are included. SPA shall ensure software development documentation is reviewed for conformance to applicable data requirements. Software development documentation reviews shall be conducted to ensure the following:

a) Software requirements specifications contain software requirements that are complete, concise, consistent, accurate, realistic, unambiguous, verifiable, and traceable to higher level requirements.
b) Software design specifications have incorporated all applicable software requirements and that the software design conforms to applicable software standards and conventions.

c) Interface documents accurately specify hardware–to–software, software–to–software, and user–to–software interfaces.

d) Software test plans describe an acceptable test philosophy and approach, software test procedures verify applicable software requirements, and software test reports accurately reflect the conduct of each test.

5.2.3.1 SPA shall evaluate software documentation delivery processes and procedures to ensure delivery of complete, correct, and compliant software documentation and change information.

5.2.4 SOFTWARE CODE INSPECTION

SPA shall selectively participate in software code inspections and walkthroughs to ensure compliance with coding standards and design requirements. SPA shall verify the completion of all software code inspections and walkthroughs prior to integration and formal testing.

5.2.5 SOFTWARE TESTING

For all deliverable software preparatory to and during formal testing, SPA shall:

a) Review and approve test plans and procedures to verify conformance of test to requirements.

b) Verify documentation of the current configuration of the total test environment prior to any formal software test activities to assure repeatability of test results and to aid in the resolution and disposition of nonconformances.

c) Verify the software and test documentation configuration to assure approved and correct versions are used for testing and to assure that only approved changes have been incorporated.

d) Selectively participate in tests and review test results to assure that test procedures have been performed, all test requirements have been met, and that actual test results are recorded.

e) Assure noncomformances are reported in accordance with paragraph 5.4.

f) Review test reports for completeness and accuracy.

5.3 CONFIGURATION MANAGEMENT

SPA shall evaluate the following CM processes to assure compliance to approved CM plans: configuration identification; configuration status accounting; configuration change control; configuration verification; and software delivery.

5.3.1 CONFIGURATION IDENTIFICATION, STATUS ACCOUNTING AND VERIFICATION

Software baselines established at the end of life–cycle phases, including configurations delivered for formal testing or for operational use, shall be evaluated or audited as appropriate to verify that the baselined configurations are correct and at the proper revision level.

5.3.2 CONFIGURATION CHANGE CONTROL

The processing and implementation of change requests shall be evaluated to assure that the product conforms to baselined requirements and standards, only approved changes were implemented, and that the change has been incorporated in accordance with approved procedures. Change requests shall be reviewed for impact on software safety, reliability, maintainability, and quality.

5.3.3 SOFTWARE DELIVERY

SPA shall ensure that software is delivered in accordance with contractual as well as ISSA level requirements for packaging and delivery. In addition, SPA shall ensure that a software ADP is prepared and maintained in accordance with SSP 30695, SSP Acceptance Data Package Requirements Specification, and SPAR–SS–DID–1205 for software deliveries that constitute a transfer of responsibility or ownership (DD 250/1149 or equivalent form).

5.3.4 SOFTWARE LIBRARIES

Software libraries shall be audited and their processes evaluated to assure adherence to baselined configuration management processes and to assure the proper storage and handling of software media and documentation. The audits and evaluations shall assure that different computer program versions are accurately identified and documented, only authorized modifications are made, modifications are made in accordance with approved procedures, and software submitted for testing or operation is the required version.

5.3.5 DEVIATIONS AND WAIVERS

SPA shall evaluate deviation and waiver requests to CSSP baselined software requirements for potential impacts affecting safety, reliability, maintainability and quality, and recommend dispositions for management concurrence.

5.4 NONCONFORMANCE/PROBLEM REPORTING AND CORRECTIVE ACTION

SPA shall ensure the establishment, implementation, and maintenance of a documented closed–loop system for nonconformance/problem reporting and corrective action throughout the software life–cycle.

5.4.1 NONCONFORMANCE REPORTING

SPA shall ensure that the nonconformance reporting system includes provisions for recording, analysis, recurrence control, verification, and generation of summary and detailed reports on software which does not conform to specifications/requirements. Nonconformances shall be documented in accordance with DR SSQ–QA–005. Nonconformance reports shall be analyzed, including trend analyses, to categorize software errors and to identify potential weaknesses in software life–cycle processes and products. Results of the analyses and the actions taken shall be documented.

5.4.2 PROBLEM REPORTING AND CORRECTIVE ACTION

Detailed requirements for problem reporting, analysis, and resolution shall be in accordance with SSP 30223, Problem Reporting and Corrective Action (PRACA). SPA shall ensure that problems that meet the criteria of SSP 30223 are entered in the SS PRACA Data System (PDS) for assessment, tracking, corrective action and closure. SPA shall ensure that procedures are in place to evaluate the impact of a reported problem, the resources required for corrective action, and the impact of not taking corrective action. The procedures shall include requirements for retesting the software and a process for incorporating the correction in new versions of the software.

5.5 SOFTWARE RELIABILITY AND MAINTAINABILITY

SPA shall ensure that software reliability and maintainability requirements are traceable to and derived from system reliability and maintainability requirements. SPA shall ensure that the software reliability and maintainability requirements have been met. SPA shall participate in the assessment of reusable software for use in lieu of a new design.

5.5.1 SOFTWARE FAULT ANALYSIS

SPA shall ensure that software fault analysis is performed and documented in conjunction with system fault tolerance and redundancy management requirements analysis. SPA shall ensure that software fault analysis is performed on software contributing to a failure identified by system reliability analysis and/or system safety hazard analysis. SPA shall ensure that software fault tolerance, is determined and documented in accordance with DR SSQ–R–005.

5.6 SOFTWARE SAFETY

SPA shall assure that analyses of software are performed as part of system safety analyses described in paragraph 2.2.3. CSA will control this activity through the process described in CSA–SS–PL–0011, Software Safety Plan For The CSSP.

5.7 STANDARDS

SPA shall assure that software development standards are established and implemented. SPA shall assure that the software development standards meet CSSP requirements and support ISSA objectives as specified in SSP 30534. SPA shall assure that the software development standards facilitate the development of safe, reliable, maintainable, and quality software products.

5.8 TRADE STUDIES

SPA shall evaluate software trade studies to ensure that safety, reliability, maintainability, and quality assurance requirements are considered. SPA shall participate in trade studies as appropriate.

5.9 INTEGRATION ASSURANCE

SPA shall ensure that a process exists to evaluate and integrate the software–to–hardware interfaces, and software–to–software interfaces, and software–to–user interfaces of the system to meet the requirements defined in the interface documentation and those contained in SSP 30459.

5.10 VERIFICATION AND VALIDATION

SPA shall ensure that verification and validation activities are performed for CSSP software in accordance with SSP 50037 Bilateral Integration and Verification plan. SPA shall ensure that traceability analyses are performed from system level requirements to detailed requirements, to design, to code. to test, and back, to assure traceability of all requirements and the exclusion of unauthorized functions.

5.11 INDEPENDENT VERIFICATION AND VALIDATION (IV&V)

CSA SPA shall ensure that IV&V is performed in accordance with CSA–SS–PL–0009, Software Independent Verification and Validation Plan. The contractor shall support this activity.

5.12 CERTIFICATION

SPA shall ensure that products requiring certification meet the following prerequisites:

a) Verification that the products were developed and supported according to an approved process.

b) Verification that all software products are present, complete, current and controlled and that no open nonconformances exist which are safety or mission critical.

c) Validation that the software products meet all of the appropriate requirements including safety and reliability requirements.

d) Validation that the software products meet the requirements contained in SSP 50037 BIVP.

e) Validation that the software products meet the requirements contained in SSP TBD (CoFR, Draft 9 September 94) .

5.13 SECURITY AND PRIVACY ASSURANCE

SPA shall ensure that system security and privacy requirements for the CSSP have been implemented in accordance approved procedures

6.0 APPLICABLE AND REFERENCE DOCUMENTS

6.1 APPLICABLE DOCUMENTS

The following documents, of the revision shown, form a part of this document to the extent specified herein. In the event of a conflict between the following documents and the contents of this document, this document shall apply.

ISSA Documents

SSP 30223 Issue D	Problem Reporting and Corrective Action (PRACA) System Requirements for the Space Station Program
SSP 30234 Issue B	Instructions for Preparation of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL) for Space Station
SSP 30423 Issue D	Space Station Approved Electrical, Electronic, and Electromechanical Parts List (SSAEPL)
SSP 30521 Issue	Space Station Freedom Program NASA Level II Quality Assurance Audit/Survey Plan
SSP 30534 Issue	SOFTWARE POLICIES AND INFORMATION SYSTEM STANDARD
SSP 30459 Issue	INTERNATIONAL SPACE STATION INTERFACE CONTROL PLAN
SSP 30599	Safety Review Process for ISSA
SSP TBD	CoFR Draft 9 Sept 94
SSP 30695 Issue	Acceptance Data Package Requirements Specification
SSP 41167	MSS Segment Specification
SSP 50005	International Space Station Flight Crew Integration Standard (NASA 3000/T)
SSP 50011–03 Revision A	Concept of Operations and Utilizations
SSP 50037	Bilateral Integration and Verification Plan.

Military Standards

MIL–STD–105 Version	Sampling Procedures and Tables for Inspection by Attributes
MIL–STD–414 Version	Sampling Procedures and Tables for Inspection by Variables for Percent Defective
MIL–STD–970 Version 1 Oct 87	Standards and Specifications, Order of Precedence for the Selection of
MIL–STD–975 Version J	NASA Standard Electrical, Electronic, and Electromechanical (EEE) Parts List

NASA Documents

NHB 1700.1 (V1–A)	Basic Safety Manual
NHB 1700.1 (V2)	Guidelines for Mishap Investigation
NHB 1700.1 (V3)	System Safety
NHB 5300.4 (3A–1)	Requirements for Soldered Electrical Connections
NHB 5300.4 (3F) 1 June 72	Quality Products Lists Requirements for Microcircuits
NHB 5300.4 (3G) 1 April 85	Requirements for Interconnecting Cables, Harnesses, and Wiring
NHB 5300.4 (3H) 1 May 84	Requirements for Crimping and Wire Wrap
NHB 5300.4 (3I) 1 May 84	Requirements for Printed Wiring Boards
NHB 5300.4 (3J) 7 Jan 86	Requirements for Conformal Coating and Staking of Printed Assemblies
NSTS 13830 Revision B	Payload Shuttle Verification Plan

CSSP Documents

CSA–SS–PL–0009 December 1993	Software Independent Verification and Validation Plan for the CSSP
CSA–SS–PL–0011 June 1994	Software Safety Plan for the CSSP
SPAR–SS–PL–0089 Issue C	Materials and Processes Requirements for CSSP
SPAR–SS–PP–0095 Issue E	Product Assurance Program Plan Space Station MSS

SPAR–SS–PP–0096 Issue F	Safety Plan Space Station MSS
SPAR–SS–PP–0097 Issue F	Reliability Plan
SPAR–SS–PL–0192 Issue D	MSS Program Plan for EEE and Mechanical Parts
SPAR–SS–PL–0273 Issue B	Instructions for the Preparation of Hazard Analyses
Spar–SS–PL–0383 Issue B	Space Station Materials and Processes Selection, Control & Verification Plan
SPAR–SS–SG–0536 Issue B	EEE Parts Requirements for MSS Program
SPAR–SS–R 0930	MSS Preferred Parts List
SPAR–SS–DID–1205 Issue B	Software Version Description Document Template.

6.2 REFERENCE DOCUMENTS

The following documents referred to herein may be utilized for information and guidance in implementing the requirements of this document.

ISSA Documents

SSP30309	Hazard Analysis and Risk Assessment Requirements Handbook

NASA Handbooks

NHB 5300.4 (A–1)	Reliability Program Requirements for Aeronautical and Space Systems Contractors
NHB 5300.4 (1B)	Quality Program Provisions for Aeronautical and Space System Contractors
NHB 5300.4 (1C)	Inspection System Provisions for Aeronautical and Space System Materials, Parts, Components, and Services
NHB 5300.4 (1D–2)	Safety, Reliability, Maintainability, and Quality Provisions for the Space Shuttle Program
NHB 5300.4 (1E)	Maintainability Program Requirements for Space Systems
NHB 5300.4 (2B–1)	Quality Assurance Provisions for Delegated Government Agencies

CSSP Documents

SPAR–SS–SG–0662	Requirements for Mechanical parts
SPAR–SS–SG–0663	CSSP Approved Parts List
SPAR–SS–PL–0515 Issue C	Software Verification and Validation Plan.

6.3 EQUIVALENCY OF PROCESS DOCUMENTS

The following matrix delineates the correspondence between CSA documents and documents called out in SSP 50062. The matrix shows the status of the determination of the Meet/Exceed equivalency of the documents. The ”TBD” specifies that CSA accepts the NASA Documents as ”Applicable”, but reserves the right to submit a request for establishment of ”Meet/Exceeds” in accordance with the meets or exceeds process. The detailed equivalency tables for the documents shown below are contained in Annex 1.

NASA	REVISION	CSA	REVISION	MEET/EXCEED EQUIVALENCY STATUS	STATUS DATE
SSP 30233 Space Station Requirements for Materials and Processes	C 26 Sept 91	SPAR–SS–PL–0383 M&P Selection, Control & Verification plan SPAR–SS–PL–0089 Materials &Processes Req’ts Definition Document	B C	Yes	24 Mar 1993
SSP 30309 Safety Analysis and Risk Assessment Requirements Document	C 14 Sept 92 with SSCBD BB003206A	SPAR–SS–PL–0096 Safety Plan MSS; SPAR–SS–PL–0273 Instructions for Preparation of Hazard Analyses	F B	Yes	16 Aug 1993

APPENDIX A ABBREVIATIONS AND ACRONYMS

ADP	Acceptance Data Package
AR	Acceptance Review
C&W	Caution and Warning
CAGE	Commercial and Government Entity
CCB	Configuration Control Board
CDR	Critical Design Review
CEI	Contract End Item
CIL	Critical Items List
CM	Configuration Management
DCR	Design Certification Review
DR	Data Requirement
EEE	Electrical, Electronic, and Electromechanical
ESD	Electrostatic Discharge
FMEA	Failure Modes and Effects Analysis
FSE	Flight Support Equipment
GFE	Government–Furnished Equipment
GIDEP	Government–Industry Data Exchange Program
GSE	Ground Support Equipment
GSI	Government Source Inspection
HAWS	Hazard Analysis Worksheet
ISSA	International Space Station Alpha
IV&V	Independent Verification and Validation
JAN	Joint Army Navy
KHB	KSC Handbook
KMI	KSC Management Instruction
KSC	Kennedy Space Center
LRU	Line Replaceable Unit
MIL	Military
MRB	Material Review Board
MUA	Materials Usage Agreement
NASA	National Aeronautics and Space Administration

NDE	Nondestructive Evaluation
NHB	NASA Handbook
NRC	National Research Council
NSPAR	Nonstandard Part Approval Request
NSTS	National Space Transportation System
ORI	Operational Readiness Inspection
ORU	Orbital Replaceable Unit
OSE	Orbital Support Equipment
OSHA	Occupational Safety and Health Administration
PIND	Particle Impact Noise Detection
PDR	Preliminary Design Review
PRACA	Problem Reporting and Corrective Action
S&PA	Safety and Product Assurance
SAR	Safety Assessment Report
SPA	Software Product Assurance
SRM&QA	Safety, Reliability, Maintainability, and Quality Assurance
SRP	Standard Repair Procedure
S.S.	Space Station
SSAEPL	Space Station Approved EEE Parts List
SSCB	Space Station Control Board
SSE	Software Support Environment
SSPE	Space Station Program Element
STD	Standard
TBD	To Be Determined
TMIS	Technical and Management Information System

APPENDIX B GLOSSARY

Audit

An audit is a formal evaluation of how well a process or product conforms to a mutually–agreed specification or plan. Auditees will be given adequate notice (2 weeks) of the audit and will be fully informed as to the specification or plan they are to be audited to.

Glossary

This appendix contains the definition of terms to be utilized in the interpretation and development of International Space Station Alpha safety and produce assurance requirements.The definitions contained in SSP 41167 take precedence in cases of conflict.

Acceptance

The act of an authorized agent of the procuring organization by which the procuring organization assents to ownership of existing and identified contract items or approves specific services rendered as partial or complete performance of a contract.

Acceptance Testing

Those formal tests conducted to assure that the equipment meets contracted requirements. Acceptance tests include performance demonstrations and environmental exposures to screen out manufacturing defects, workmanship errors, incipient failures, and other performance anomalies not readily detectable by normal inspection techniques or through ambient functional tests.

Accepted Risk

A hazard that has not been eliminated and the residual risk is deemed low enough to continue operation and has been accepted by project/program management on the basis of documented risk acceptance rationale.

Accident

An unplanned event that results in personnel fatality or injury; damage to an International Space Station Alpha Program Element (SSPE), to the environment, or to public or private property; or the loss of any SSPE's. See Incident.

Airborne Support Equipment (ASE)

The flight equipment and systems, such as test equipment, tools, gages, handling devices, etc., needed to support ISSA operations from assembly through end–of–life.

As–Built Electrical, Electronic, and Electromagnetic (EEE) Parts List

A list of the actual EEE parts installed in the hardware during fabrication for each of the respective circuit designators.

As–Designed Electrical, Electronic, and Electromagnetic (EEE) Parts List

A list of EEE parts that have been selected during the design phase for use in the fabrication of the hardware and reflected by the assembly drawing bill of materials.

Availability

The probability that an item will be in a satisfactory operating condition at a random point in time.

Certification

A process which may be incremental, by which a contractor provides objective evidence to the contracting agency that an item satisfies its specified requirements.

Certification Analysis

Analysis performed to satisfy certification objectives when testing under simulated mission conditions is not feasible or cost effective or the need exists to extrapolate test data beyond the performed test points or analysis performed to show that an article is similar or identical in design, manufacturing process, and quality control to another that has been previously certified to equivalent or more stringent criteria.

Certification Testing

The process of conducting tests which normally are considered qualification tests plus specific additional tests of components and subsystems and higher levels of assemblies required to certify that the hardware design meets established design requirements. Certification testing does not generally include development, piece–part qualification, acceptance, or checkout tests except where such tests are specifically identified as required for certification.

Component

A combination of parts, devices, and structures, usually self–contained, which perform a distinctive function in the operation of the overall equipment such as a “black box.”

Consolidated Procurement

An acquisition approach where all EEE parts are controlled, procured, and distributed by a single activity.

Corrective Action

Action taken to preclude occurrence of an identified hazard or to prevent recurrence of or resolve a problem.

Critical Characteristics

Any physical attribute of an article or material which if defective can cause loss of life or equipment, or make the article or material nonfunctional.

Critical Item

A single failure point and/or hardware item(s) (including redundant items) in a life– or mission–operations essential application which does not meet the program failure tolerance requirements, or where:

Item(s) cannot be checked out before being required to operate prelaunch or in orbit,

Item(s) whose loss cannot be detected by the flight or ground crew during any mission phase, or

Item(s) which cannot be restored on orbit.

Critical Mission Support

”TBD”

Criticality

The relative measure of the consequences of a failure mode.

Criticality Categories (Reliability Analyses)

Criticality Categories are as defined in SSP 30234

Design Specification

Generic designations which describe functional and physical requirements for an article, material, or service.

Destructive Physical Analysis

Analysis of EEE parts samples to assure that the internal construction, quality, and condition of samples do not vary from lot to lot.

Development Configuration

The contractors software and associated technical documentation that defines the evolving configuration of a computer software configuration item (CSCI) during development. It is under the development contractors configuration control and describes the software design and implementation.

Deviation

Specific authorization, granted before the fact, to depart from a particular elements requirement, specification, or related document. See Waiver.

Fail Operational

Having the ability to sustain a failure and retain full operational capability.

Fail Safe

The ability to sustain a failure and retain the capability for safe crew and International Space Station Alpha operations.

Failure

The inability of a system, subsystem, component, or part to perform its required function within specified limits under specified conditions for a specified duration.

Fault Detection

The capability of testing equipment or systems to give an operator or technician a go/no–go indication.

Fault Isolation

The capability of testing equipment or systems to indicate to the technician where the failure has occurred.

Fault Tolerance

(1) The ability to continue to operate in the presence of anomalies or failures.

(2) The number of failures which can be allowed without disruption of nominal functional performance.

Fault Tolerant

Having the built–in capability to provide continued correct execution in the presence of an allowed number of hardware or software faults.

Firmware

Computer programs and data loaded in a class of memory that cannot be dynamically modified by the computer during processing or in its user environment.

Flight Software

Software hosted within International Space Station Alpha flight elements.

Flight Support Software

Software which directly supports International Space Station Alpha services and is not hosted within International Space Station Alpha flight elements.

Hazard

An existing or potential condition that can result in a mishap.

Controlled Hazard

A hazard that has been reduced in risk severity, probability of occurrence, or time exposure by design provisions or by special procedures.

Eliminated Hazard

A hazard that has been eliminated by removing the hazard source. The hazard source will be eliminated by design or by deleting the hazardous operation.

Hazard Analysis

The determination of potential sources of danger, causes, effects, hazard level, and recommended resolution for those conditions found in either the hardware/software system, the person–machine relationship, or both, which could cause loss of personnel capability, loss of system, or loss of life/injury to the public.

Hazard Levels for Safety Analyses

Catastrophic. Any condition induced by personnel error, environmental effects, or flight/ground hardware or software failures which may cause a permanent disabling or fatal personnel injury, or loss of one of the following: the launch or servicing vehicle, manned core station element, an ISSA Payload (user) (during ground processing through assembly on–orbit), an on–orbit life sustaining function, a ground facility, or any critical ground support equipment.

Critical. Any condition induced by personnel error, environmental effects, or flight/ground hardware or software failures which may cause a nondisabling personnel injury, severe occupational illness, or loss of an emergency system, or requires the use of emergency procedures or involves major damage to one of the following: the launch or servicing vehicle, manned core station element ISSA Payload (user) (during ground processing through assembly on–orbit), an on–orbit life sustaining function, a ground facility, or any critical ground support equipment.

Marginal. Any condition induced by personnel error, environmental effects, or flight/ground hardware or software failures which may cause major damage to an emergency system or minor personnel injury, minor occupational illness, or minor damage to one of the following: the launch or servicing vehicle, a manned core station element, an ISSA Payload (user) (during ground processing through assembly on–orbit), an on–orbit life sustaining function, ground facility, or any critical ground support equipment.

Negligible. Any condition induced by personnel error, environmental effects, or flight/ground hardware or software failures which may cause minor damage to an emergency system or an injury/illness to personnel that requires no treatment, or damage to one of the following: the launch or servicing vehicle, a manned core station element, an ISSA Payload (user) (during ground processing through assembly on–orbit), an on–orbit life sustaining function, ground facility, or any critical ground equipment.

Incident

An unplanned, minor event or episode that can lead to an accident. See Accident.

Limited–Life Item

Any item designated as having a limited useful life in relation to its application. Limited life includes operating time or cycles and age life.

Limited–Operating–Life Item

Any item which deteriorates with increased accumulation of operating time/cycles and thus requires periodic replacement or refurbishment to assure that its operating characteristics have not degraded beyond acceptable limits. This includes consideration for total mission time/cycles and safety factor margins.

Limited–Age–Life Item

Any item which deteriorates with the passage of time and thus requires periodic replacement, refurbishment, retesting, or operation to assure that its operating characteristics have not degraded beyond acceptable limits. This includes installed as well as stored components.

Line Replaceable Unit (LRU)

An item which can be removed from a system and replaced as a unit at the organizational level of repair action.

Lot

Articles produced in a given time sequence with no changes in materials, tooling, processes, personnel, techniques, or configuration.

Maintainability

Characteristics of design and installation of an item which enables it to be retained in or restored to a specified operational condition by using prescribed resources and procedures.

Maintenance

The function of keeping an item in or restoring it to a specified operational condition.

Mishap

Event that results in death, injury, or illness; in damage to property or equipment; or in a mission or test failure that has significant program impact or visibility.

Nonconformance

A condition of any article or material or service in which one or more characteristics do not conform to contractual requirements. Includes failures, discrepancies, defects, and malfunctions.

Non–Developmental Software

Deliverable software that is not developed under the contract but is provided by the contractor, the Government, or a third party. Non–developmental software may be referred to as reusable software, Government furnished software, or commercially available software depending on its source.

NonStandard Parts Approval Request

Request for approval of parts that are not listed in MIL–STD–975 and/or the Space Station Approved EEE Part List (SSAEPL) or in the case of the CSA the CSSP Approved Parts List.

— Nonstandard EEE Part. A EEE part not listed in MIL–STD–975, NASA Standard EEE Parts List or SSAEPL or in the case of the CSA the CSSP Approved Parts List.

— Standard Part. A EEE part listed in MIL–STD–975, NASA Standard EEE Parts List or SSAEPL or in the case of the CSA the CSSP Approved Parts List.

— Grade 1 (or CSSP Equivalent Grade). The classification used for higher quality standard parts intended for applications that the responsible NASA or CSSP project office has determined to be critical. (See definitions of Grade 1 and Grade 2 specific part type as stated within MIL–STD–975 and/or SSAEPL or the CSSP Approved Parts List.)

— Grade 2 (or CSSP Equivalent Grade(s)). The classification used for standard parts which meet the criteria for inclusion within the applicable standard and are intended for applications not requiring Grade 1 parts.

Off–The–Shelf Hardware

Production of existing design hardware (black box, component) used in or for the National Aeronautics and Space Administration (NASA), CSA , military, and/or commercial programs.

Off–The–Shelf Design

An existing design for equipment with known characteristics and proven history that has not been manufactured.

Off–The–Shelf Equipment

Equipment of an existing design that has been manufactured and is available for delivery.

Operating Cycles

The cumulative number of times an item completes a sequence of activation and returns to its initial state.

Operating Life

The maximum operating time or cycles which an item can accrue before replacement or refurbishment without risk of degradation of performance beyond acceptable limits.

Orbital Replaceable Unit (ORU)

The lowest level of component or subsystem hardware that can be removed and replaced under orbital conditions.

Overstress

A value of any stress parameter in excess of the upper limit of the normal working range or in excess of specified value.

Part

One or more pieces joined together which are not normally subject to disassembly without destruction.

Deviated Parts

Parts deviating to any degree from their controlling specifications.

EEE Parts

All parts listed in MIL–STD–975 such as capacitors, diodes, transistors. connectors, crystals, hybrid microcircuits, protective devices, filters, thermistors, resistors, switches, relays, transformers, and inductor.

—Nonstandard EEE Part. A EEE part not listed in MIL–STD–975; NASA Standard EEE Parts List, the SSAEPL or applicable CSSP Approved Parts List. Grade 2 parts used in Grade 1 or Class S applications are nonstandard.

—Standard EEE Part. A EEE part listed in MIL–STD–975; NASA Standard EEE Parts List, the SSAEPL or applicable CSSP Approved Parts List.

—Class S Parts. The highest reliability/quality level for semiconductors for use in critical space applications as defined by the NASA Project Office (See Class S definition in MIL–S–38510 for integrated circuits and hybrid parts and JAN S definition in MIL–STD–19500 for diodes and transistors).

—Grade 1. The classification used for higher quality standard parts intended for applications that the responsible NASA project office has determined to be critical.

—Grade 2. The classification used for standard parts which meet the criteria for inclusion with the applicable standard and are intended for applications not requiring Grade 1 or Class S parts.

Substitutes Parts

Parts differing from those specified in the approved parts list for the equipment design. Use requires NASA approval prior to installation.

Problem

Any nonconformance which fits or which is suspected of fitting one of the following categories:

—Failure or unsatisfactory condition occurring, during, or subsequent to production acceptance testing.

—Failure or unsatisfactory condition which occurs prior to acceptance testing that will affect or has the potential of adversely affecting safety, will contribute to schedule impact or launch delay, or will result in the need for design change, or indicates a generic EEE parts concern (trend).

Problem Analysis

A documented investigation performed to determine the cause of a problem.

Problem Cause

The event or series of events directly responsible for a problem.

Problem, Closed

Per SSP 30223.

Problem, Explained

Per SSP 30223.

Problem Reporting and Corrective Action (PRACA)

A controlled technique for identifying, reporting, analyzing, explaining, and preventing recurrence of problems.

Process Certification

The process of assuring the capability of personnel and/or acceptability of equipment/materials/procedures prior to performance of operations affecting product quality. PROCUREMENT DOCUMENTS

Such documents as purchase orders, subcontracts, statements of work, technical specifications, and intercorporate work orders required to define articles, materials, and services being procured and the terms and conditions imposed.

Product Assurance

A function that includes the Reliability, Maintainability, and Quality Assurance, (RM&QA) disciplines.

Qualification Tests

Tests conducted as part of the certification program to demonstrate that design and performance requirements can be realized under specified conditions.

Recurrence Control

Action taken to prevent repetition of a nonconformance.

Redundancy

The existence of more than one means for performing a given function.

Reliability

A characteristic of a system or an element thereof expressed as a probability that it will perform its required functions under defined conditions at designated times for specified operating periods.

Remedial Action

Action to correct a nonconformance.

Repair

Operations performed on a nonconforming article or material to place it in a usable and acceptable condition; requires additional written procedures and additional operations.

Restorable

The ability to reinstate specified operating conditions in an item by appropriate maintenance action.

Reusable Software

Software developed in response to the requirements for one application that can be used, in whole or in part, to satisfy the requirements of another application.

Rework

The continuation of processing of articles and materials that will make them conform to drawings, specifications, procedures, or contract. Requires only normal operations to complete the article or material in accordance with the applicable documents and does not require additional written procedures.

Risk

The chance (qualitative) of loss of personnel, loss of system or damage to, or loss of equipment or property.

Safety

Freedom from chance of injury or loss of personnel, equipment, or property.

Safety Analysis

The techniques used to systematically evaluate and resolve hazards.

Safety Critical

Any condition, event, operation, process, equipment, or system with a potential for personnel injury or fatality, damage to or loss of equipment or property.

Single Failure Point

A single item of hardware the failure of which could lead directly to loss of life, SSPE, or critical mission support capability.

Software

Machine instructions, including firmware, in the form of codes, data, and associated documentation.

Software NonConformance

A software nonconformance is defined as any deviation of any software product or process from baselined requirements, standards, or procedures.

Space Station Approved EEE Parts List (SSAEPL)

A list of standard parts developed and maintained by NASA to provide parts, part types, and part technologies not contained in MIL–STD–975 and which are suitable for general application in ISSA design.

Specification

Document or combination of documents controlling the design parameter (i.e., materials used, physical and electrical characteristics, screen test performed, etc.) of the device. Controlling documents may include the following:

— Selected Item Drawing

— Specification Control Drawing and Source Control Drawing

— Altered Item Drawing

— Military Slash Sheet

System Safety

The optimum degree of risk management within the constraints of operational effectiveness, time, and cost attained through the application of management and engineering principles throughout all phases of a program.

Unsatisfactory Condition

Any defect for which resolution is required and which requires recurrence control beyond the specific article being considered. Included in this definition are conditions which cannot be corrected to the specified configuration using the standard planned operations. Also included are conditions (e.g., contamination, corrosion, or workmanship) requiring engineering disposition which could lead to a failure.

Verification

A process which determines that the ISSA hardware and software systems meet all design, performance, and safety requirements. The verification process includes analysis, test, inspection, demonstration, or a combination thereof.

Waiver

A written authorization, granted after the fact, for use or acceptance of an article which does not meet specified requirements. See Deviation.

APPENDIX C
DATA REQUIREMENTS DOCUMENTS (DRs)

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. DID P.1101–29	PAGE 1 of 2	DATE REV. 08/94 – CB

3. TITLE:

EVA/EVR/IVA Budget Report

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	

6. FREQUENCY OF SUBMISSION:

As Required

7. INITIAL SUBMISSION:

01/07/93

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

Documents MSS crew maintenance time resource predictions.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. DID P.1101–29	PAGE 2 of 2	DATE REV. 08/94 – CB
3. TITLE: EVA/EVR/IVA Budget Report				
10. INTERRELATIONSHIP:		11. REFERENCES: SSP 50062, 3.2.6		12. ORGANIZATION:

13. PREPARATION INFORMATION:

This document shall report the predictions for crew maintenance time needed for MSS ORUs. The aggregate crew maintenance time for MSS and its subsystems shall also be reported. The predictions shall be compared to resource allocations and the ORUs which are the most significant shall be identified.

The document shall contain, as a minimum, the following data for the ORUs defined in the ORU list for MSS, SPAR–SS–R–0613.

a) Predicted MTBF

b) Estimated Operating Life

c) Duty Cycle

d) On–Site Task Time

e) Quantity of crew required to perform the maintenance task

f) Maintenance action rate

g) Crew Maintenance Time per year

NOTE: The methodology used to derive items f) and g) shall be described.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. DID P.1101–512	PAGE 1 of 2	DATE REV. 08/94 – CB

3. TITLE:

Reliability and Availability Data Report

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	

6. FREQUENCY OF SUBMISSION:

7. INITIAL SUBMISSION:

15/10/95, 15/02/97

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

Documents MSS reliability and availability data.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. DID P.1101–512	PAGE 2 of 2	DATE REV. 8/94 – CB
3. TITLE: Reliability and Availability Report				
10. INTERRELATIONSHIP:		11. REFERENCES: SSP 50062, 3.2.6	12. ORGANIZATION:	

13. PREPARATION INFORMATION:

This document shall contain as a minimum, the following:

a) ORU level MTBF estimates,

b) System level reliability block diagram

c) Calculation of system operational reliability

d) Description of methodology used,

e) Identification of system reliability drivers.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO.	PAGE	DATE REV.
		SSQ–EEE–007	1 of 2	6/89

3. TITLE:

ALERT System Documentation

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	

6. FREQUENCY OF SUBMISSION:

A. GIDEP ALERT Impact Assessment. As required to support the assessment of ALERTs distributed by the GIDEP system.
B. Contractor Initiated ALERTs. As required to support release, revision, and clarification of prepared ALERTs as the specific problem may dictate.

7. INITIAL SUBMISSION:

A. GIDEP ALERT Impact Assessment. Response due to the responsible NASA Center within 45 days.
B. Contractor Initiated ALERT. Draft ALERT due to the responsible NASA Center within ten working days of identifying the problem as requiring the issuance of a GIDEP ALERT.

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

A. GIDEP ALERT Impact Assessment. Provides the contractor’s recommendation for corrective actions to SS hardware.

B. Contractor–Initiated ALERTs. Provides notification to other NASA contractors of significant problems encountered which may impact their equipment.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–EEE–007	PAGE 2 of 2	DATE REV. 6/89
3. TITLE: ALERT System Documentation				
10. INTERRELATIONSHIP:		11. REFERENCES: SSP 50062, 3.3.3.1 SSP 30312, 6.0; Appendix N, Failure Analysis Guidelines	12. ORGANIZATION:	

13. PREPARATION INFORMATION:

A. GIDEP ALERT Impact Assessment.

1. Scope. Provides responses to problem associated with ISSA hardware identified by GIDEP ALERTs.
2. Contents. Responses to GIDEP ALERTs shall identify the hardware to which the response applies and an analysis of the problem with recommendations and/or corrective action accomplished.
3. Format. Initial response by problem report system final closeout.
4. Maintenance. Not applicable.

B. Contractor Initiated ALERTs.

1. Scope. Provides NASA contractors notification of problem encountered with ISSA hardware.
2. Contents. Contractor–initiated ALERTs shall identify the where–used hardware and provide the detailed information required by GIDEP ALERTs preparation and coordination.
3. Format. GIDEP Form DD–1938.
4. Maintenance. Not applicable.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–SPA–001	PAGE 1 of 3	DATE REV. 6/89

3. TITLE:

Software Product Assurance (SPA) Plan

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
1	Electronic Access

6. FREQUENCY OF SUBMISSION:

Revise and submit no later than 30 days prior to implementation of change or as required to maintain plan.

7. INITIAL SUBMISSION:

Initial plan with proposal. Final plan 60 days after CSD.

8. REMARKS:
Plans shall be provided by electronic submission or electronic access in an approved format.

DATA REQUIREMENT DESCRIPTION

9. USE:

The plan shall describe the proposed implementation of SPA requirements

10. INTERRELATIONSHIP:	11. REFERENCE:	12. ORGANIZATION:
Software Management Plan	SSP 50062, 5.1.2	

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–SPA–001	PAGE 2 of 3	DATE REV. 6/89

3. TITLE:

Software Product Assurance (SPA) Plan

13. PREPARATION INFORMATION:

A. Scope. The plan shall address the organization, processes, schedules, objectives, and resources required to achieve product assurance for software. The plan shall as a minimum include the SPA requirements of paragraph 5.1.2

B. Contents. The plan shall as a minimum include the following information;

1. Statement of scope, applicable SPA requirements, and affected software, software processes, and support software and hardware.
2. Description of tasks including relationships to the software development effort including programmatic tasks, special studies, and support tasks.
3. A task matrix defining primary and support organizational responsibilities.
4. Identification of policies, procedures, and formats to be used in analysis tasks.
5. Identification of products to be developed by the tasks.
6. A program schedule for task accomplishment and product submittal.
7. Methods for implementation of SPA tasks.

C. Format.

1. Cover. The cover shall contain the organization's name and address, title of document, date of release, contract number, and DR number.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–SPA–001	PAGE 3 of 3	DATE REV. 6/89

3. TITLE:

Software Product Assurance (SPA) Plan

13. PREPARATION INFORMATION CONTINUED

2. Title Page. Same information as the cover page plus signature block fr cognizant authority's signature.

3. Table of Contents. Major divisions and subdivisions of the plan shall be listed. Each entry shall include a page number reference.

4. Introduction. A concise and self–explanatory summarization of the plan shall be provided and include, as a minimum, objectives, scope, technical considerations, accomplishments, and constraints.

5. Main Body of Document. The information required by the content section of this DR and any additional information which is appropriate shall be provided.

6. References. A list of references including author, title, and source shall be included.

7. Appendices. Supplemental or incidental information, detailed tabulations or derivations, or graphic representations shall be provided as appendices.

D. Maintenance. Update and resubmit plan as required to maintain and adjust implementation of SPA requirements in concert with program activities. Status reports shall be periodically submitted to report the status for implementation accomplishment, and preparation for plan objectives and activities. The status reports shall be submitted in preparation for program milestones. The period for submittal for the status reports shall not exceed 90 days.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–001	PAGE 1 of 3	DATE REV. 6/89

3. TITLE:

Plan, Quality

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
1	

6. FREQUENCY OF SUBMISSION:

Revisions 60 days following any major event which requires modification of the plan.

7. INITIAL SUBMISSION:

Initial plan with proposal. Final plan 60 days after contract start date. The launch site quality appendix will be submitted 60 days prior to the first hardware delivery to the launch site.

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

To describe the implementation of the Quality Assurance requirements by the responsible organization.

10. INTERRELATIONSHIP:	11. REFERENCES:	12. ORGANIZATION:
DR: Inspection and Test Procedures, Quality Assurance Review	SSP 50062 4.1.3	Quality Assurance

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT		2. DR NO.	PAGE	DATE REV.
No.	Issue	SSQ–QA–001	2 of 3	6/89

3. TITLE:

Plan, Quality

13. PREPARATION INFORMATION:

A. Scope. The quality plan shall identify all elements of the quality assurance organization, and describe the objectives, implementing policies and procedures, and control systems utilized throughout design, development, procurement, fabrication, delivery, and usage to provide quality articles and materials.

B. Contents. Each element of the ISSA Quality Assurance requirements document SSP 50062, shall be addressed in narrative form and in sufficient detail to describe the philosophy and approach to implementation by the quality assurance organization. Existing policies and procedures may be utilized where cited requirements can be met.

C. Launch Site Quality. An appendix to the quality plan shall be created to describe the launch site quality plan requirements including the latest revision of KMI1710.1, Safety, Reliability, and Quality Assurance Programs.

D. Format.

1. Cover. The cover shall contain the organization's name and address, title of document, date of publication, contract number (if applicable), and Data Requirement Document number.
2. Title Page. Same information as cover page plus signature block for appropriate authority's signature.
3. Table of Contents. Shall list major divisions and subdivisions of the plan. Each entry shall include a page number reference.
4. Introduction. Shall be a concise summarization of the plan and shall be self–explanatory, presenting such information as the objectives, scope, technical considerations, accomplishments, constraints, etc.
5. Main Body of the Document. Shall present the information required as outlined in the content paragraph of this DR plus additional data as determined necessary by the program.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–001	PAGE 3 of 3	DATE REV. 6/89
3. TITLE: Plan, Quality				

13. PREPARATION INFORMATION (CONTINUED)

6. References. A list of references shall be included showing author, title, sources, etc.

7. Appendices. Shall be used when necessary to present supplemental or incidental information, detailed tabulations or deviations, or graphic representations.

E. Maintenance. Updated by reissuance of affected pages.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–002	PAGE 1 of 2	DATE REV. 6/89

3. TITLE:

On–orbit Quality Planning

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	(1) Cognizant CSA Quality Assurance organization (2) Responsible maintenance organization

6. FREQUENCY OF SUBMISSION:

Final submittal 90 days after CDR.

7. INITIAL SUBMISSION:

Initial submission 30 days prior to CDR.

8. REMARKS:

To assure on–orbit inspections are planned and integrated into the on–orbit maintenance plan.

DATA REQUIREMENT DESCRIPTION

9. USE:

To identify required inspections, inspection tools, frequency of inspection, calibration requirements, and associated training for on–orbit activities.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO.	PAGE	DATE REV.
		SSQ–QA–002	2 of 2	6/89

3. TITLE:

On–orbit Quality Planning

10. INTERRELATIONSHIP:	11. REFERENCES:	12. ORGANIZATION:
DR: Reliability Plan On–orbit Maintenance Plan Assembly Sequence Plan	SSP 50062 4.1.4	Quality Assurance

13. PREPARATION INFORMATION:

A. Scope. The evaluation shall be accomplished at the ORU/Additional Maintenance Item (AMI), maintenance, and assembly levels and shall consider items such as failure modes, failure causes, assembly sequence, and criticalities identified on the FMEA.

B. Contents. The planning shall include as a minimum the following information:

1. Pertinent data elements from the FMEA down to the ORU/AMI level
2. Required inspections, including NDE, resulting from failures, routine or preventive maintenance, and assembly activities.
3. Identification of specific inspection tools required to perform the inspections (built–in or carry–on).
4. Establishment of inspection frequencies.
5. Calibration requirements.
6. Training required to accomplish identified inspections and calibrations.

C. Format. To be submitted in matrix form utilizing the six items enumerated in “B” above.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–003	PAGE 1 of 2	DATE REV. 6/89

3. TITLE:

Report, Management Assessment Data

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	

6. FREQUENCY OF SUBMISSION:

Monthly, may be combined with monthly status report. Separate reporting after CDR.

7. INITIAL SUBMISSION:

Initial submission 30 days after CSD.

8. REMARKS:

This report shall include similar data from major subtier organizations.

DATA REQUIREMENT DESCRIPTION

9. USE:

To provide the next higher management level with a summary of program Quality Assurance activity.

10. INTERRELATIONSHIP:	11. REFERENCES:	12. ORGANIZATION:
DR: Package, Acceptance Data	SSP 50062 4.1.5	Quality Assurance

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–003	PAGE 2 of 2	DATE REV. 6/89

3. TITLE:

Report, Management Assessment Data

13. PREPARATION INFORMATION:

A. Scope. The report shall include significant accomplishments, known or potential hardware problems, summary of remedial action and recurrence control, quality costs, and presentation of pertinent data, such as scrap rates, trend charts, and nonconformances.

B. Contents. The report shall include, as a minimum, the following information:

1. Significant accomplishments. Submission of required documentation support to major milestones, resolution of problems having a program impact, etc.
2. Known or potential problems having a significant impact and recommendations for resolution.
3. Quality Costs. Identification of costs such as prevention, correction of nonconforming supplies (labor and material) and scrap costs.
4. Nonconformances
5. Trend Charts. Nonconformance totals related to cause.

C. Format. The format shall be established by the cognizant organization presenting the material in a logical and related manner, highlighting those elements requiring attention of CSA management. May be presented in management meetings with CSA.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 1 of 10	DATE REV. 6/89

3. TITLE:

Package, Acceptance Data

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	

6. FREQUENCY OF SUBMISSION:

As required with each shipment of equipment to destination.

7. INITIAL SUBMISSION:

Submitted with first shipment of equipment.

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

The Acceptance Data Package (ADP) will provide the documentation needed by the using activity to put the end item into use and/or operation.

10. INTERRELATIONSHIP:	11. REFERENCE:	12. ORGANIZATION:
	SSP 50062 4.6.4.2 SSP 30695	Quality Assurance

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 2 of 10	DATE REV. 6/89

3. TITLE:

Package, Acceptance Data

13. PREPARATION INFORMATION:

A. Scope. The ADP shall be arranged according to the following format and contain information necessary to assist the using organization in controlling , maintaining, statusing, and using the end item equipment.

B. Contents.

1. Title Page. The cover page of the deliverable data package will identify the item being delivered as follows:

— Deliverable item part name, number, and serial number

— Model number (if applicable)

— Contract number (if applicable)

— Contractor/supplier name (if applicable)

2. Index page. This page identifies the type of hardware, associated data and applicable sections contained in the ADP as follows:

— Deliverable item part name, part number, and serial number

— Type of hardware (flight or GSE)

— Content (identified by checking appropriate block) of the applicable data element section contained in the deliverable data package

— Appropriate deliverable data package approval signatures and date (including certificate of conformance to contract requirements)

3. DD250/1149 (Or other Recognized Government CSA/NASA Shipping Documents). This form will be required for all shipments and shall include the appropriate quality control validation and shall be prepared in accordance with applicable CSA/NASA regulations. The shipping document shall include:

— Deliverable item name, part number and serial number(s), and lot number

— Quantity shipped

— Shortages/open work

— The shipping document will list the ADP as being part of the shipment.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 3 of 10	DATE REV. 6/89
3. TITLE: Package, Acceptance Data				
13. PREPARATION INFORMATION:		CONTINUED		

4. Component/Equipment Historical Logs. Commencing with acceptance testing and inspection, a log (JSC form 772, System and Component Historical Record, or equivalent) should be maintained to continuously document the history of the item or component. Each log will be chronologically maintained and will include dates, operating times or cycles, adjustments, modifications, operations or tests performed and all failures or anomalies (with cross–referencing to problem reports), special inspections or any other significant activity such as storage. Entries will be complete, self–explanatory, traceable to the originator and validated by quality assurance. Logs shall be included into the next higher assembly's data package upon installation of the item into the next higher level of assembly.
5. Notes/comments Used For Documenting. This section of the ADP shall be annotated with the following information to provide a more complete history of the equipment:

— Unusual phenomena (occurrence, difficulty, or questionable condition during fabrication and testing)

— Potential hazards to personnel or equipment

— Additional information, notes, cautions/warnings that may be beneficial to using site (e.g., cleanliness requirements, actions required before and after use, verification data, alignment data, proof pressure certification of flex hoses, etc.)

— Affected next assembly part name, number, and serial number

— Inspection, test, and retest requirements per appropriate documentation after installation of hardware appearing on shortage listing

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 4 of 10	DATE REV. 6/89

3. TITLE:

Package, Acceptance Data

13. PREPARATION INFORMATION: CONTINUED

6. Unplanned/Deferred Work: Unaccomplished fabrication, test, inspection, or installation activities remaining to be completed at time of acceptance and delivery due to shortages, lack of schedule time, etc., including open discrepancy reports and other open work, applicable to equipment being delivered. This section shall include:

— Deliverable equipment part name, number, and serial number

— Affected part number of specification

— Description of unplanned/deferred work including a list of open or unincorporated modification kits and engineering orders which should have been accomplished prior to delivery

— Inspection, test, and retest requirements per appropriate documentation to complete unplanned/deferred work

7. Preplanned/Assigned Work: Description of work from manufacturing and/or test authorized for accomplishment after delivery which is deferred for safety reasons, is required to restore the item from alterations/differences necessary for shipping, or deferred to allow end item delivery although component delivery shipped.

— Deliverable item part number/serial number

— Authorizing document identification

— Description of preplanned/assigned work or planning document

— Inspection/verification requirements per approved documentation to complete preplanned/assigned work

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 5 of 10	DATE REV. 6/89

3. TITLE:

Package, Acceptance Data

13. PREPARATION INFORMATION: CONTINUED

8. Identification As–built Configuration: An indentured parts list of the hardware being delivered shall define the difference between the assigned as–designed configuration and the as–built configuration and supporting rationale for differences. The configuration listing specifically consists of:

— Subsystem, assembly, and subassembly hardware (traceable and nontraceable)

— Parts procured to a source control drawing (traceable and non–traceable)

— Parts procured to a specification control drawing (traceable only)

For purposes of this requirement, the as–built configuration excludes specification control drawing parts which are exempt from traceability and standard usage hardware (e.g., nuts, bolts, washers, shims, pins).

— The as–built configuration list shall contain:

— Deliverable item part number/serial number

— Part indenture level

— Part number, part serial, or lot number [including Government Furnished Equipment (GFE), when applicable]

— Quantity

— Drawing traceability code

— Drawing change letter and incorporated Engineering Orders (EO)

— For EEE parts: Circuit board assembly, part numbers, part manufacturers, and part lot date codes/serial numbers

9. Operating Time/Cycle. Status at the time of delivery of accumulated operating time and/or critical cycles of parts designated as time/cycle critical.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 6 of 10	DATE REV. 6/89
3. TITLE: Package, Acceptance Data				

13. PREPARATION INFORMATION: CONTINUED

— Delivery item part number/serial number

— Time/cycle part name, part number/serial number

— Allowable (specification requirement) and remaining operating time and/or cycles from point of delivery

10. Age–Sensitive/Time–Action Items. Limited–life items have a maximum life limit and are subject to replacement when specified limit is reached or exceeded. Included are time action control items having a minimum periodic functional operating limit and are subject to replacement when one or more of specified limits are exceeded. The age–sensitive/time–actions list shall include:

— Deliverable item part number/serial number

— Age–sensitive/time–action part name, part number/serial number, birth date, expiration date (action due date), and type of action required (i.e., replace, service, inspect, etc.)

— Last operation and/or servicing date and next operation and/or servicing due date (time action items only)

11. Nonstandard Calibration. Record of measurement equipment, instrumentation, components, or systems having nonstandard calibration curves shall be provided at time of delivery. The record shall include the following:

— Deliverable item part number/serial number

— Component/transducer/signal conditioner gage or meter, part number, and serial number

— Measurement number—from master measurement list

— Range (engineering units), excitation volts (+), units stimulus (engineering units) and output volts or resistance

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 7 of 10	DATE REV. 6/89

3. TITLE:

Package, Acceptance Data

13. PREPARATION INFORMATION: CONTINUED

— Temperature environment, calibration date, and stimuli values output expressed in engineering units or percent of full range

— Actual calibration tabulated data points and/or calibration curves as specified in the sensor/signal conditioner component procurement documents will be required at the time of delivery

12. Nonflight Hardware/Temporary Installation. A listing of installed hardware which is not part of the deliverable item configuration and must be removed prior to subsequent operations or flight shall be provided. The list shall include the following:

— Deliverable item part number/serial number

— Identification method (tag and/or streamer serial number)

— The temporarily installed part name, part number/serial number

— Physical location of the temporarily installed part and identification of when item is to be removed (i.e., prior to test, prior to flight, etc.)

13. Pressure Vessel Data. A log of each pressure vessel's exposure to materials and pressure shall be provided at time of delivery [Ground Support Equipment (GSE) exclusion: American Society of Mechanical Engineers (ASME) Code for Unfired Pressure Vessels, Section VIDI, 1986 Edition, are excluded from the log requirements.. However, an ASME form U–1, prepared in accordance with ASME code, shall be provided at time of delivery. Requirements are specified on ASME form U–1]. The log shall include the following:

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 8 of 10	DATE REV. 6/89

3. TITLE:

Package, Acceptance Data

13. PREPARATION INFORMATION: CONTINUED

— Deliverable item part number/serial number

— Pressure vessel's part name, part number/serial number

— Limited life requirements

— Chronological test and checkout history

  — Proof pressure data/certification

  — Leak test data

  — Cycling data

  — Magnitude of pressure

  — Total number of pressure cycles

  — Type of pressurant (test media)

14. Nonfunctional Items. A suitable inspection status tag, SSP Form 911, or equivalent shall accompany each nonfunctional item, in lieu of a data package. This tag will contain, as a minimum, the following information:

— Part name

— Part number and serial/lot number

— Cleanliness certification

— Proof pressure/proof loading certification (if applicable)

— Material certification (if applicable)

— Evidence of contractor quality acceptance

— Evidence of CSA quality acceptance

This tag does not negate drawing requirements for part identification, nameplates, etc., but solely indicated the part inspection status.

15. Waiver/Deviation Record. CSA approved waivers and deviations to the contract authorizing hardware delivery with existing variations, as applicable to the physical/functional parameters of the item being delivered (i.e., form, fit, function).

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 9 of 10	DATE REV. 6/89
3. TITLE: Package, Acceptance Data				

13. PREPARATION INFORMATION: CONTINUED

— Deliverable item part number/serial number

— Waiver/deviation number and, if applicable, affected part number and serial number

— A copy of actual waiver/deviation document with detailed description and contract authority

16. Repair Limitation. When repair limitations are imposed by the design agency (i.e., limits the number of times a specific hardware type can be repaired), then a status of these limited repair item which have had prior repair activity but have not reached the specific limit shall be identified at the delivery.

— Deliverable item part number/serial number

— Type of repair (i.e., bent pins, brazed joints, etc.)

— Source of the requirement (i.e., specification, etc.)

— Identification method (i.e., painted, tagged, charted, etc.)

— Part number, serial/lot number of the affected item

— Physical location of the affected item

— Number of prior repairs

17. Pyrotechnic Data. Documented evidence that representatives of the responsible CSA (and the procuring agency) have reviewed and accepted the described pyrotechnic devices on the basis of applicable CSA and procuring agency specifications and requirements.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–004	PAGE 10 of 10	DATE REV. 6/89

3. TITLE:

Package, Acceptance Data

13. PREPARATION INFORMATION: CONTINUED

This documentation consists of the lot certificate, which includes the certification of the device lot at time of acceptance and shall be provided with each device lot.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO.	PAGE	DATE REV.
		SSQ–QA–005	1 of 3	6/89

3. TITLE:

Record, Nonconformance

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
3	

6. FREQUENCY OF SUBMISSION:

N/A

7. INITIAL SUBMISSION:

Upon request

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

To provide that all nonconformances are documented in a consistent manner and to assure that all necessary data elements are included

10. INTERRELATIONSHIP:	11. REFERENCE:	12. ORGANIZATION:
DR: Problem Report and Problem Closeout/ Explanation Report	SSP 50062, 4.7.2	Quality Assurance

13. PREPARATION INFORMATION

A. Scope. This DR establishes the minimum data elements necessary to provide

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–005	PAGE 2 of 3	DATE REV. 6/89

3. TITLE:

Record, Nonconformance

13. PREPARATION INFORMATION: CONTINUED

records of the closed loop system for control of nonconformances. Nonconformance recording shall commence with initial receipt of materials or articles for the procurement and continue through all subsequent phases of the program.

B. Contents. the record used for recording, analysing, remedial action, recurrence control, verification,and feedback of data shall include the following data elements;

1. A unique and traceable number.
2. The nomenclature and identification of the nonconforming article or material.
3. A description of the required characteristic or design criteria and a specific definition of the nonconformance.
4. The initiator of the document.
5. Nomenclature and part number of next assembly.
6. Date that the nonconformance was discovered.
7. Type of activity being conducted; e.g., fabrication, assembly, qualification test, system test, predelivery or preinstallation test, etc.; reference must be made to applicable procedure numbers.
8. Disposition (remedial action) required to make the nonconforming article or material acceptable for use.
9. Signatures of personnel authorized to provide disposition.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–005	PAGE 3 of 3	DATE REV. 6/89

3. TITLE:

Record, Nonconformance

13. PREPARATION INFORMATION: CONTINUED

10. Verification by inspection that the remedial action prescribed in the disposition was acceptably completed.
11. For material review board dispositions, verification by the government quality representative that the remedial action was satisfactorily completed.
12. Cause or reason for the nonconformance, including area function or activity responsible for causing the nonconformance.
13. Recurrence control actions taken.
14. Cross reference to the failure/problem report where required.
15. Final closure indication after all remedial. and recurrence control actions are complete.
16. NCR classification (ie. class 1 or class 2) using MIL–STD–1520 as a guideline for classification definition.

C. Format. As required to include data elements listed in contents (B).

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–006	PAGE 1 of 2	DATE REV. 6/89

3. TITLE:

Deviation/Waiver to Program Contract Requirement

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
1	

6. FREQUENCY OF SUBMISSION:

As required

7. INITIAL SUBMISSION:

8. REMARKS:
Deviations/Waivers shall be submitted to the next higher level of authority

DATA REQUIREMENT DESCRIPTION

9. USE:

Documents acceptance/disposition of any deliverable hardware nonconformance which adversely affects safety, reliability, maintainability, performance, weight, or appearance (if a factor), interface requirements, or other contract requirements.

10. INTERRELATIONSHIP:	11. REFERENCE:	12. ORGANIZATION:
Configuration Management	, SSP 50062, 4.7.5.B.4	Quality Assurance

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT		2. DR NO.	PAGE	DATE REV.
No.	Issue	SSQ–QA–006	2 of 2	6/89

3. TITLE:

Deviation/Waiver to Program Contract Requirement

13. PREPARATION INFORMATION:

A. Scope. Provides proposal for and written authorization to accept an item which during the course of design, development, procurement, manufacture or test, or after having been submitted for inspection, is found to depart from a program or contract requirement.

B. Contents.

1. Identification of effectivity.
2. Identification of discrepant part or system by title and model, part and serial numbers.
3. Explanation if discrepancy involves safety, maintainability, reliability, performance, weight, interface requirements, or basic objectives of program or contract requirements.
4. Number, title, and paragraph of affected program or contract documentation.
5. Identification of and cross reference with control documentation related to deviations/waivers.
6. Detailed description of discrepancy.
7. Rationale for acceptance and assessment of risk involved.
8. Approving signatures and date.
9. Effects of delivery schedule
10. Estimate of cost reductions or increases.
11. Reference to related deviations/waivers.

C. Format. All organizations shall use the deviation/waiver form (TBD)

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO.	PAGE	DATE REV.
		SSQ–QA–007	1 of 4	6/89

3. TITLE:

Problem Report and Problem Closeout/Explanation Report

SUBMITTAL REQUIREMENTS

4. TYPE:

1—Resolution
2—Report

5. DISTRIBUTION:

6. FREQUENCY OF SUBMISSION:

As required

7. INITIAL SUBMISSION:

Initial report due within 24 hours after isolation to Line Replaceable Unit (LRU)/ORU level or within 48 hours after isolation to LRU/ORU level if occurring at a subtier facility. Complete report due within 5 days of reportable item identification. Subsequent updates required.

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

To document problems.

10. INTERRELATIONSHIP:	11. REFERENCE:	12. ORGANIZATION:
DR: Deviation/Waiver to Program Contract Requirement	SSP 50062, 4.7.6 and 5.4	Quality Assurance

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–007	PAGE 2 of 4	DATE REV. 6/89

3. TITLE:

Problem Report and Problem Closeout/Explanation Report

13. PREPARATION INFORMATION:

A. Scope. The scope of the problem report varies according to the nature of the problem.

1. Reporting shall include all problems that occur during or subsequent to acceptance testing of flight hardware, flight software, GSE, and any departure from specified design or test limits resulting in actual or suspected overstress to deliverable hardware or software occurring during any phase of fabrication, inspection, or testing.
2. GSE reporting is limited to GSE problems which would result in loss of personnel capability or loss of ISSA systems.
3. Closeout/explanation reports shall document efforts in successfully determining the cause of the problem for which corrective action has been established and documentation released to implement corrective action. The report shall document efforts taken to determine the cause of a problem. Failing this, the report shall document that recurrence of the problem during a mission can be tolerated and that procedures to nullify the effects of the problem have been formulated.

B. Contents.

1. Required elements in initial report (type 2 requirement):

— Date and time of occurrence

— Location of article at time of occurrence (facility or site)

— Test or operation being performed at time of occurrence (certification, acceptance, final checkout) (when applicable)

— Prevalent conditions at time of occurrence (vibration, shock,etc.) (if applicable)

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–007	PAGE 3 of 4	DATE REV. 6/89

3. TITLE:

Problem Report and Problem Closeout/Explanation Report

13. PREPARATION INFORMATION: CONTINUED

— Nonconforming article: part number, part name, serial number, lot number, manufacturer (as applicable)

— Contractor deliverable end–item model number

— Symptom of nonconformance

— Brief narrative description of nonconformance, including comparison of expected events with actual events (or results)

— Criticality of nonconformance with relationship to mission effects (if known)

— Cause of nonconformance (if known)

— Test document number (if applicable)

— Subsystem affected (if known)

Additional required elements for the complete report:

— Uniquely identifiable report number

— Indication of whether nonconformance is a failure or unsatisfactory condition (if known)

— Indication of whether or not problem is launch constraining

— Indication of whether or not a generic trend has been established

— Next higher assembly; part name, part number, serial number, manufacturer (as applicable)

— All end items that may be affected by the problem (if know)

— Planned date of resolution

2. Elements required for closeout explanation of the problem report (type 1 requirement)

— Results of analysis, including laboratory tests and secondary effects caused by a EEE parts failure

— Corrective action that has been established including reference to released documentation establishing this corrective action

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–QA–007	PAGE 4 of 4	DATE REV. 6/89

3. TITLE:

Problem Report and Problem Closeout/Explanation Report

13. PREPARATION INFORMATION: CONTINUED

— Efforts made to determine nonconformance cause (explanation)

— Updated cause of nonconformance (if applicable)

— Contract number

— Time/cycles in use, if applicable

— Date of resolution

— Problem report numbers. and date, that relate to the same problem

— Explanation rationale (explanation)

— Assurance that explanations using redundancy and/or alternate modes of operation as one of the elements do not negate each other (explanation)

— When last test article, prior to launch, is to be performed and statement as to whether or not the nonconformance is detectable during mission (explanation)

— Effect of problem closeout/explanation

— All end items that may be affected by the problem

C. Format. NASA problems reporting and corrective action data elements shall be in accordance with SSP 30223, Problem Reporting and Corrective Action (PRACA) System Requirements for the SSP.

D. Maintenance. Update as available.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–001	PAGE 1 of 4	DATE REV. 6/89

3. TITLE:

Reliability Plan

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
1	

6. FREQUENCY OF SUBMISSION:

Revisions 30 days following any event requiring modification of the plan to reflect changes to the reliability program.

7. INITIAL SUBMISSION:

Preliminary plan with proposal. Final plan 60 days after Contract Start Date (CSD).

8. REMARKS

The plan for accomplishing Electrical, Electronic, and Electromechanical (EEE) Parts Control tasks (paragraph 3.3) may be submitted under separate cover, with customer approval, if appropriate based on organizational responsibilities.

DATA REQUIREMENT DESCRIPTION

9. USE:

The plan shall define the contractors planned methods of accomplishing the applicable tasks required to satisfy the reliability requirements of SSP 50062.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–001	PAGE 2 of 4	DATE REV. 6/89
3. TITLE: Reliability Plan				
10. INTERRELATIONSHIP:		11. REFERENCES: SSP 50062, 3.1.2		12. ORGANIZATION:

13. PREPARATION INFORMATION:

A. Scope. This DR establishes the preparation information requirements of the subject plan.

B. Contents. The plan shall include, but not be limited to, the following information:

1. A detailed description of how each specified reliability management, engineering, and EEE parts control task will be performed or complied with (including special studies and support tasks).
2. A task matrix defining the primary and support organizational and personnel responsibilities for managing and implementing the reliability requirements.
3. A description of the interrelationships of reliability tasks and activities with other related tasks.
4. A description of innovative, cost–effective methods of accomplishing the management and implementation of the reliability tasks.
5. An identification of formats and ground rules to be used in analysis tasks.
6. Identification of products to be developed from the reliability tasks (e.g., design analyses, test planning, program reports, etc.).
7. Identification of the controls and evaluation techniques to be used for the generation of reliability data.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–001	PAGE 3 of 4	DATE REV. 6/89
3. TITLE: Reliability Plan				

13. PREPARATION INFORMATION: CONTINUED

8. A program schedule for task accomplishment, output product submittals, and program reviews.
9. A description of the method by which the reliability requirements and products will be disseminated to designers and associated personnel.
10. A description of the producers for controlling, monitoring, and assessing inherent reliability design characteristics during all phases of the program.
11. Methods of training and indoctrination of all affected personnel.

C. Format.

1. Cover. The cover shall identify the performing organization, contain the document title, date of publication, contract number (if applicable), and DR number.
2. Title Page.Same information as cover page plus signature block for cognizant authority's signature.
3. Table of contents. Shall list major divisions and subdivisions of the plan. Each entry shall include a page number reference.
4. Introduction. Shall be a concise summarization of the plan and shall be self–explanatory, presenting such information as the objectives, scope, technical considerations, accomplishments, constraints, etc.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–001	PAGE 4 of 4	DATE REV. 6/89
3. TITLE: Reliability Plan				

13. PREPARATION INFORMATION: CONTINUED

5. Main Body of the Document. Shall present the information required as outlined in the content paragraph of this DR plus additional data as determined by the performing organization.
6. References. If required, a list of references shall be included showing author, title, sources, etc.
7. Appendices. Shall be used when necessary to present supplemental or incidental information, detailed tabulations or derivations, or graphic representations.

D. Maintenance. Updated by reissuance of affected pages.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–002	PAGE 1 of 2	DATE REV. 6/89

3. TITLE:

Failure modes and Effects Analysis (FMEA)

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	

6. FREQUENCY OF SUBMISSION:

Revised analysis 30 days prior to CDR. Updates as required

7. INITIAL SUBMISSION:

Initial draft 30 days prior to PDR.

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

To identify failure modes and effects to support the following: additional design action, safety analysis, hardware/software interface analyses, test planning, mission planning, preparation of mandatory inspection points, fault detection and isolation, maintainability analyses and planning, maintenance planning, and logistics planning.

10. INTERRELATIONSHIP:	11. REFERENCE:	12. ORGANIZATION:
FMEA developed in conjunction with design engineering	SSP 50062, 3.2.3 SSP 30234, Instructions for Preparation of FMEA/CIL for Space Station	

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–002	PAGE 2 of 2	DATE REV. 6/89

3. TITLE:

Failure modes and Effects Analysis (FMEA)

13. PREPARATION INFORMATION:

The FMEA shall be prepared in accordance with SSP 30234, Instructions for Preparation of FMEA/CIL for Space Station.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–003	PAGE 1 of 2	DATE REV. 6/89

3. TITLE:

Critical Items List (CIL)

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
1	

6. FREQUENCY OF SUBMISSION:

Revised analysis 30 days prior to CDR, Acceptance Reviews (ARs) and prior to flight. Updates as required

7. INITIAL SUBMISSION:

Initial draft 30 days prior to PDR.

8. REMARKS

DATA REQUIREMENT DESCRIPTION

9. USE:

To identify critical items which require special risk assessment to support; waivers to program requirements, additional design action, safety analysis, test planning, mission planning, preparation of mandatory inspection points, fault detection and isolation, maintainability analyses and planning, maintenance planning, and logistics planning.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO.	PAGE	DATE REV.
		SSQ–R–003	2 of 2	6/89

3. TITLE:

Critical Items List (CIL)

10. INTERRELATIONSHIP:	11. REFERENCES:	12. ORGANIZATION:
Developed in conjunction with FMEAs, design engineering and operations planning	SSP 50062, 3.2.4; SSP 30234, Instructions for Preparation of FMEA/CIL for Space Station	

13. PREPARATION INFORMATION:

The CIL shall be prepared in accordance with SSP 30234, Instructions for Preparation of FMEA/CIL for Space Station

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–004	PAGE 1 of 2	DATE REV. 6/89

3. TITLE:

Limited–Life Items List

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	

6. FREQUENCY OF SUBMISSION:

Submit lists 30 days prior to PDR and CDR. Updates as required.

7. INITIAL SUBMISSION:

Initial submission 30 days prior to PDR.

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

To control ISSA Program limited–life items.

10. INTERRELATIONSHIP:	11. REFERENCE:	12. ORGANIZATION:
Limited–life items developed in conjunction with design engineering	SSP 50062, 3.2.7	

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–004	PAGE 2 of 2	DATE REV. 6/89

3. TITLE:

Limited–Life Items Lists

13. PREPARATION INFORMATION:

A. Scope. Identify time/cycle sensitive components and age controlled items and related requirements for inspection, maintenance, and replacement of these items. Limited–life items include limited–shelf life, limited–operating life, time–action control sensitive items, or a combination of these.

B. Contents.

1. Items shall be identified by part name and number, life limit, life–limiting parameter or part/material and its function, and any limitations on number of refurbishments, any restrictions related to operational use, test, handling, inspection or maintenance.
2. Requirements for historical data/records to verify that age sensitive items are controlled within acceptable limits.

C. Format. To be prepared in contractor’s specification format.

D. Maintenance. Revisions to be in accordance with the contractor’s engineering release system.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–005	PAGE 1 of 3	DATE REV. 6/89

3. TITLE:

Software Fault Tolerance Analysis

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	Electronic Access

6. FREQUENCY OF SUBMISSION:

Updates forty–five days prior to software milestone reviews and as required to maintain a current representation of the software configuration.

7. INITIAL SUBMISSION:

Initial submission to occur concurrent with initial submission of system configuration.

8. REMARKS

Analysis shall be provided by electronic submission or electronic access in an approved format.

DATA REQUIREMENT DESCRIPTION

9. USE:

The fault tolerance analysis shall analyze the structure of crew safety, SSPE survival, and mission critical software to determine the fault tolerance, effects, criticality, and detection for use in influencing software design, test, operations, and maintenance.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–005	PAGE 2 of 3	DATE REV. 6/89

3. TITLE:

Software Fault Tolerance Analysis.

10. INTERRELATIONSHIP:	11. REFERENCES: SSP 50062, 5.5.7	12. ORGANIZATION:

13. PREPARATION INFORMATION:

A. Scope. All software which directly supports International Space Station Alpha systems operations shall be analyzed. The scope of analysis shall include software which can adversely affect crew safety, SSPE survival or mission critical functions.

B. Contents. A preface shall be provided which describes the rules, procedures, and definitions used in the analysis. The types and effects of all faults shall be determined for each software element. Safety Critical faults will be those faults that disrupt ISSA safety or operations. The results of the fault tolerance analyses shall include as a minimum the following information:

All Faults:

1. A description of the software system, subsystem, or module shall be provided, including inputs, outputs, and algorithms and processes. The description shall include information such as software element title, identification number, and release or version. Engineering representations such as logic diagrams and source code shall be made available to support review of the analysis results.
2. A list of assumptions used in the analysis shall be provided.
3. The functional criticality, as defined in appendix A, for software element and the degree of fault tolerance for the potential faults shall be specified.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–R–005	PAGE 3 of 3	DATE REV. 6/89

3. TITLE:

Software Fault Tolerance Analysis

13. PREPARATION INFORMATION: CONTINUED

4. A description of the mechanism used to provide fault tolerance shall be provided.

5. A list of potential faults and the effects of each fault, including system services affected and the time for the effect to be manifested, shall be described. Sufficient detail shall be provided on the relationship of the software element to system services to support conclusions for system effects.

All Safety Critical Faults:

1. A description of the possible causes of the fault, safeguards and tests for preventing the fault, and methods for detection shall be provided.

2. The mechanism for isolation of and recovery from the fault shall be described.

3. Retention rationale shall be provided to justify the use of software which can critically impact station safety or operations.

C. Format. The format shall be compatible with the Software Support Environment (SSE) Fault Analysis or an approved alternative. The analysis results shall be sortable by the software elements in a relationship similar to the structure of the software system.

D. Maintenance. The analysis and results shall be maintained as required to reflect current software configurations in support of program milestones.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–S–001	PAGE 1 of 4	DATE REV. 6/89

3. TITLE:

Safety Plan

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
1	

6. FREQUENCY OF SUBMISSION:

A revised plan is to be submitted to NASA 30 days following any event requiring modification of the CSSP Safety plan.

7. INITIAL SUBMISSION:

Preliminary plan shall be submitted to NASA 60 days after the release of the Joint Management Plan. Launch Site Safety Plan (Appendix A) will be submitted 60 days prior to the first hardware delivery to the launch site

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

10. INTERRELATIONSHIP:	11. REFERENCE:	12. ORGANIZATION:
SSP 50062, 1.3, 1.4	SSP 50062, 2.1.3	

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–S–001	PAGE 2 of 4	DATE REV. 6/89

3. TITLE:

Safety Plan

13. PREPARATION INFORMATION:

A. General. The plan shall define the functions and activities involved with system safety, occuptional safety and health and industrial safety, and test operations safety. Existing contractor/subcontractor plan(s) may be used in part or in total to satisfy the intent of the requirement.

B. System Safety. The system safety section of the plan shall comply with SSP 50062, paragraph 2.2, System Safety. This section of the plan shall include the following:

1. A definition of the safety organization, the safety engineer/safety manager, and key personnel. Points of contact and interfaces with other organizations having responsibility for safety of product shall be identified.
2. A description of the safety tasks to be performed during the ISSA Program in sufficient detail to assure compliance with paragraph 2.1.3
3. A description of the methods that will be used to perform these safety tasks, control the effort, accomplish the objectives, and verify compliance with requirements.
4. Identification of the safety output that will result from the effort, the expected application of the effort, with provisions for the documentation of specific results of the safety effort.

.

5. Scheduling the safety effort including milestone identification, program activities, phasing, integration, and product delivery.
6. The system safety section shall be updated to reflect any changes to the key elements of the system safety program.

DATA REQUIREMENT (DR)

1. No.	DATA PROCUREMENT Issue	2. DR NO. SSQ–S–001	PAGE 3 of 4	DATE REV. 6/89

3. TITLE:
Safety Plan

13. PREPARATION INFORMATION: CONTINUED

C. Industrial Safety. The industrial safety section of the plan shall implement safety requirements consistent with Federal, State, and local government regulations, levels of government regulations that apply at the particular site, including the applicable Occupational Safety and Health Administration (OSHA) regulations. This section shall describe the industrial safety organization including the structure of management interfaces. The basic safety tasks shall be identified and shall include safety assessments/analyses, safety training/certification responsibilities, generation/review of safety significant procedures, and inspection/review participation. Provisions shall be identified to govern the safety significant aspects of applicable facilities, including design, construction, and operation. Methods employed to ensure compliance with applicable safety requirements shall be identified. Methods shall be identified to govern safety ground handling and operations of flight hardware, test hardware, and associated GSE in accordance with NSS/GO 1740.9, NASA Safety Standard for Lifting Devices and Equipment.

D. Test Operations Safety. The test operations safety section shall address participation in Operational Readiness Inspections (ORIs); hazardous testing; performing safety analyses and safety assessments; monitoring of hazardous manned tests and selected hazardous unmanned tests; verification of man–rating of simulators; and review and approval of test plans and test procedures.

E. Launch Site Safety. Appendix A to the safety plan shall be created to describe the launch site safety plan requirements including KHB 1700.7A ”Space Transportation System Payload Ground Safety Handbook”

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–S–001	PAGE 4 of 4	DATE REV. 6/89

3. TITLE:
Safety Plan

13. PREPARATION INFORMATION: CONTINUED

F. Format.

1. Cover. The cover shall identify the performing organization, contain the document title, date of publication, contract number (if applicable), and DR number.
2. Title Page. Same information as cover page plus signature block for cognizant authority's signature.
3. Table of Contents. Shall list major divisions and subdivisions of the plan. Each entry shall include a page number reference.
4. Introduction. Shall be a concise summarization of the plan and shall be self–explanatory, presenting such information as the objectives, scope, technical considerations, accomplishments, constraints, etc.
5. Main Body of the Document. Shall present the information required as outlined in the content paragraph of this DR plus additional data as determined by the performing organization.
6. References. If required, a list of references shall be included showing author, title, sources, etc.
7. Appendices. Shall be used when necessary to present supplemental or incidental information, detailed tabulations or derivations, or graphic representations.

G. Maintenance. Updated by reissuance of affected pages.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–S–002	PAGE 1 of 2	DATE REV. 6/89

3. TITLE:

Safety Assessment Reports (SARs), Hazard Reports

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
1	

6. FREQUENCY OF SUBMISSION:

to NASA: incremental submittals in accordance with the schedule as in SSP 30599 Safety Review Process

to CSA: thirty days prior to each applicable contractor end item milestone review [Preliminary Design Review (PDR), Critical Design Review (CDR), Design Certification Review (DCR), Operational Readiness Inspection (ORI), and Flight Readiness Review (FRR)]. Each hazard database input shall be entered into the applicable program approved database as soon as the hazards are identified or modified.

7. INITIAL SUBMISSION:

Thirty days prior to PDR/SRR for each contractor end item for the Safety Assessment Report (SAR).

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

Summarize the results of hazard analyses and risk assessments and provide overall risk visibility of CSSP.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–S–002	PAGE 2 of 2	DATE REV. 6/89
3. TITLE: Safety Assessment Reports (SARs), Hazard Reports				
10. INTERRELATIONSHIP:		11. REFERENCES: SSP 50062, 2.2.3 and 2.2.10		12. ORGANIZATION:

13. PREPARATION INFORMATION:

The SAR shall summarize the results of hazard and analyses and qualitative risk assessments. The background, purpose and scope of the analysis effort shall be presented along with a summary of the safety analysis, discussion and status of hazards, and appendices as listed in SSP 30309 as modified by the ”Meets or exceeds” agreement IC 003496. Hazard database input shall be prepared using the format defined in SSP 30309 Rev E.

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–S–006	PAGE 1 of 2	DATE REV. 6/89

3. TITLE:

Mishap Reporting and Investigation

SUBMITTAL REQUIREMENTS

4. TYPE:	5. DISTRIBUTION:
2	

6. FREQUENCY OF SUBMISSION:	N/A

7. INITIAL SUBMISSION:

No later than twelve hours after occurrence (by telephone/electronic mail) for mishaps defined in paragraph 13 of this DR.

8. REMARKS:

DATA REQUIREMENT DESCRIPTION

9. USE:

Provide notification and status of investigation of accidents/incidents related to the International Space Station Alpha Program. Contribute to the Mishap Database and disseminate lessons learned to all SS organizations to preclude recurrence of similar mishaps and to strengthen the overall SS accident prevention program.

10. INTERRELATIONSHIP:	11. REFERENCES:	12. ORGANIZATION:
	NHB 1700.1 (V1&V2) SSP 50062, 2.1. 8	

DATA REQUIREMENT (DR)

1. DATA PROCUREMENT No.	Issue	2. DR NO. SSQ–S–006	PAGE 2 of 2	DATE REV. 6/89

3. TITLE:

Mishap Reporting and Investigation

13. PREPARATION INFORMATION:

All mishaps occurring during manufacturing, testing, and operations and meeting the criteria as specified in NHB 1700.1 (V1A), ”Basic Safety Manual”. NHB 1700.1 (V2), ”Guidelines for Mishap Investigation” [or International Partner specification which meet or exceed NHB 1700.1 (V1–A) and HB 1700.1 (V2) shall be reported by telephone/electronic mail after the occurrence to the Program Manager through the Safety Management Office. That office shall report the mishap occurrence by telephone/electronic mail to the next higher procuring/contracting office and to the Safety Management Office as contractually agreed. A reproducible copy of the report shall be provided to the subordinate/prime contractor Safety Management Office, Level III Safety Division, and Level II, Chief, Safety Division (Code SSQ) as appropriate, dependent upon the program level at which the mishap occurred. Interim reporting of the mishap findings, causal factors, and any other facts and circumstances surrounding the mishap, shall be conducted in accordance with contractually applicable documents. Accident report data shall be entered into TMIS.

ANNEX 1 TO APPENDIX C
NASA “MEETS OR EXCEEDS”

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309 MEETS OR EXCEEDS SUBMISSION									
NASA DOCUMENT		**SPAR–SS–PL–0273 CSA DOCUMENT**		**SPAR–SS–PP–0096 CSA Document**		**MEETS OR EXCEEDS**			**COMMENTS**
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	**YES**	**NO**	**N/A**	
PREFACE	Preface							/	Applicability determined by JCSA 30000 Sec.9
INTRODUCTION	1.0			PURPOSE	1.1	/			
PURPOSE	1.1	PURPOSE	1.1	PURPOSE	1.1	/			
SCOPE	1.2	SCOPE	1.2	SCOPE	1.2	/			
APPROACH	1.3	SCOPE	1.2			/			
DOCUMENTATION	2.0							/	Applicability determined by JCSA 30000 Sec.9
APPLICABLE DOCUMENTS	2.1							/	Title
SSP DOCUMENTS	2.1.1							/	Applicability determined by JCSA 30000 Sec. 9
SSP 30000, Sec. 9:, Sec. 3								/	Applicability determined by JSCA 30000 Sec. 3 &Sec. 9
SSP 30525								/	Applicability determined by JCSA 30000 Sec. 9
TSS 30599, TSS 30688						/			CSA agrees with current version of SSP 30599 Safety Review Process
TSS 30234								/	Applicability determined by JCSA 30000 Sect. 9
NASA HANDBOOKS NHB 1700.1 (VI.A);	2.1.2							/	Applicability determined by JCSA 30000 Sect. 9
NSTS 1700.7B;						/			SPAR–SS–SG–0276, Para 2.3.1
NHB 5300.4 (ID–2)				Industrial Safety	5.0	/			Guidebook

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309
MEETS OR EXCEEDS SUBMISSION

NASA DOCUMENT		SPAR–SS–PL–0273 CSA DOCUMENT		SPAR–SS–PP–0096 CSA Document		MEETS OR EXCEEDS			COMMENTS
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	YES	NO	N/A	
REFERENCE DOCUMENTS	2.2							/	
HAZARD ANALYSES	3.0	SCOPE	1.2	SAFETY ANALYSES	4.3	/			
HAZARD IDENTIFICATION	3.1	IDENTIFICATION OF FAULT RELATED HAZARDS IDENTIFICATION OF GENERIC HAZARDS HAZARD IDENTIFICATION DATA SOURCES	2.1.4 2.1.3 2.1.2	Safety Reviews and Boards	3.3.2	/			CSA provides available Fault Trees to NASA via the normal design review process as part of the data package and with subsequent Hazard Reports. (0278 will be updated to show this.)
Preliminary Hazard Analysis	3.1.1	BACKGROUND	3.1	PRELIMINARY HAZARD ANALYSIS	4.3.1	/			
	3.1.1.2.3			SAFETY ANALYSIS PRELIMINARY HAZARD ANALYSIS	4.3 4.3.1	/			(Frequency of occurrence will be added to 0273)
	3.1.1.5	FORMAT & DATA ELEMENT DESCRIPTIONS	3.2			/			
SUBSYSTEM HAZARD ANALYSIS AND SYSTEM HAZARD ANALYSIS	3.1.2	FORMAT & DATA ELEMENT DESCRIPTIONS	3.2	Subsystem/SYSTEM HAZARD ANALYSES AND FAULT TREES	4.3.2	/			
OPERATING & SUPPORT HAZARD ANALYSIS	3.1.3	FORMAT & DATA ELEMENT DESCRIPTIONS	4.2	VERIFICATION CHECKLIST OPERATING AND SUPPORT HAZARD ANALYSIS HAZARD ELIMINATION & CONTROL HUMAN ENGINEERING	4.2.2 4.3.3 4.4 4.6	/			

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309
MEETS OR EXCEEDS SUBMISSION

NASA DOCUMENT		SPAR–SS–PL–0273 CSA DOCUMENT		SPAR–SS–PP–0096 CSA Document		MEETS OR EXCEEDS			COMMENTS
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	YES	NO	N/A	
FAILURE MODES AND EFFECTS ANALYSIS CROSS–CHECK	3.1.4			SAFETY ANALYSIS	4.3	/			
OTHER IDENTIFICATION SOURCES	3.1.5			SAFETY REPORTS	4.15	/			(Requirement that any credible reports will be considered as input will be added to paragraph 4.15 of 096)
HAZARD CLASSIFICATION	3.2	HAZARD SEVERITY CLASSIFICATION	2.1.1			/			(Criticality definitions will be aligned with 30309)
SPACE STATION HAZARD DATABASE	3.3	FORMAT: DATA ELEMENT DESCRIPTIONS	3.2 4.2			/			This is a requirement on NASA to provide a database which is available to all participants
HAZARD REPORT FORM	3.4							/	
SOFTWARE ANALYSIS	3.5							/	
PURPOSE	3.5.1			SAFETY ANALYSIS	4.3	/			
DESCRIPTION	3.5.2			ORGANIZATION	3.2	/			Software safety analyses are specified in SPAR–SS–PP–0099, Software Product Assurance Plan & the results included in the overall system analyses
PROGRAM PHASING	3.5.3			SAFETY APPROACH	3.1	/			See Figure 3–1
APPLICATION OF RESULTS	3.5.4			SAFETY APPROACH	3.1	/			
APPROACH	3.5.5					/			SPAR–SS–PL–0099, Para 6.1.2, Assurance of Tools and Facilities
DATA REQUIRED	3.5.6					/			SPAR–SS–PL–0099, Para 6.1.2, Assurance of Tools and Facilities

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309
MEETS OR EXCEEDS SUBMISSION

NASA DOCUMENT		SPAR–SS–PL–0273 CSA DOCUMENT		SPAR–SS–PP–0096 CSA Document		MEETS OR EXCEEDS			COMMENTS
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	YES	NO	N/A	
DOCUMENTATION	3.5.7			SAFETY APPROACH	3.1	/			
Figure 3.3–1 SPACE STATION HAZARD									Title
FIELDS FOR SPACE STATION HAZARD DATABASE		FORMAT & DATA ELEMENT DESCRIPTION	3.2 4.2			/			
1) Hazard Title		Hazardous condition/Element	[11]						
2) Hazard ID No:		Operation	[1]			/			(F&DE contents will be aligned with 30309)
3) Revision Date:		Reference No.	[8]			/			
4) System:		OFHA No.	[2]			/			
5) Risk Index: Severity		Hazard Level	[15]			/			(Likelihood of occurrence will be added to 0273)
6) Hazard Description:		Fault or Accident	[12]			/			
7) Program Phases(s):			[ ]						(Will be completed for all phases applicable to CSSP. 0273 will be updated to reflect this.)
8) Hazard Cause(s):		Hazard Cause	[13]			/			
9) Worst Case Hazard Effect:		Hazard Effects (3.2) Potential Effects (4.2)	[14]			/			
10) Interfaces			[ ]			/			(CSA will do an initial assessment. 0273 will reflect this.)
11) Detection & Warning Method(s)			[ ]			/			Field number to be added later, Reference to FMEA will be added to this field. If no FMEA, then methods will be described here

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309 MEETS OR EXCEEDS SUBMISSION									
NASA DOCUMENT		**SPAR–SS–PL–0273 CSA DOCUMENT**		**SPAR–SS–PP–0096 CSA Document**		**MEETS OR EXCEEDS**			**COMMENTS**
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	**YES**	**NO**	**N/A**	
12) Safety Requirement(s):		Safety Requirements	[16]			/			
13) Control Method(s):		Hazard Controls (3.2) Corrective Action (4.2)	[17]			/			
14) Method of Verification of Control(s):		Safety Verification Methods	[16]			/			(F&DE description and contents will be aligned with 30309)
15) Status of Open Work:		Status/Waiver No.	[18]			/			Responsibility, completion date and closure will be added to field contents and description
16) Reference(s):			[ ]			/			(F&DE contents will be aligned with 30309)
17) Remarks:		Recommendations/Remarks	[18]			/			
18) Hazardous Materials:			[ ]			/			
19) Release and Closure		Status/Waiver (3.2)	[18]			/			
Status:		O&SHA Para 4.2	[ ]			/			(F&DE description and contents will be aligned with 30309)

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309 MEETS OR EXCEEDS SUBMISSION									
NASA DOCUMENT		**SPAR–SS–PL–0273 CSA DOCUMENT**		**SPAR–SS–PP–0096 CSA Document**		**MEETS OR EXCEEDS**			**COMMENTS**
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	**YES**	**NO**	**N/A**	
RISK ASSESSMENT	4.0		[ ]			/			CSA conducts a qualitative risk assessment at the highest level of Integration of the Canadian supplied elements, including failures across element interfaces, including payloads; i.e., the SSRMS, MBS, and the SPDM. The results of these assessments are presented to , and discussed with NASA, at CSS Program reviews, or highlighted through specific correspondence.
Purpose	4.1			Objectives	4.1d	/			QRA is only to be performed on a case–by–case, as determined by Level II and with full program concurrence.
Objectives	4.2							/	Level II responsibility – no requirements on CSA
Treatment of Safety Risk in the SSP	4.3							/	Level II responsibility – no requirements on CSA
Features of Safety Risk Assessment and Management	4.3.1							/	Level II responsibility – no requirements on CSA
Hazard Analysis and Safety Risk Assessment	4.3.2							/	Level II responsibility – no requirements on CSA

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309 MEETS OR EXCEEDS SUBMISSION									
NASA DOCUMENT		**SPAR–SS–PL–0273 CSA DOCUMENT**		**SPAR–SS–PP–0096 CSA Document**		**MEETS OR EXCEEDS**			**COMMENTS**
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	**YES**	**NO**	**N/A**	
SAFETY RISK ASSESSMENT INSTRUCTIONS	4.4							/	Introduction to the 12 step process that follows – no requirements on CSA
Step 1:Define Objectives	4.4.1							/	Level II responsibility – no requirements on CSA
Step 2: Develop System Familiarization	4.4.2					/			Level II responsibility. Familiarize with the MSS can be achieved through program documentation available to NASA through the program review process. (See paragraph 4.0)
Step 3: Define Success Criteria	4.4.3					/			Level II lead activity. CSA will provide available program information to Level II on request, or provide access to data at Spar.
Step 4: Develop Initiating Event Categories	4.4.4					/			Level II lead activity. CSA will provide available program information to Level II on request, or provide access to data at Spar.
Step 5: Develop Top Level Scenarios	4.4.5					/			Level II lead activity. CSA will provide available program information to Level II on request, or provide access to data at Spar.

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309 MEETS OR EXCEEDS SUBMISSION									
NASA DOCUMENT		**SPAR–SS–PL–0273 CSA DOCUMENT**		**SPAR–SS–PP–0096 CSA Document**		**MEETS OR EXCEEDS**			**COMMENTS**
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	**YES**	**NO**	**N/A**	
Step 6: Integrate Level II Fault Tree with Level III/IP Fault Tree	4.4.6					/			Level II lead activity. CSA will provide available program information to Level II on request, or provide access to data at Spar.
Step 7: Determine which Scenarios Require Quantification	4.4.7					/			(Description of process for determining which hazards merit QRA will be added to 096) Level II lead activity. CSA will provide available program information to Level II on request, or provide access to data at Spar.
Step 8: Develop Database	4.4.8					/			Level II lead activity. CSA will provide available program information to Level II on request, or provide access to data at Spar.
Step 9: Develop Basic Event Frequency Distributions	4.4.9							/	Level II lead activity
Step 10: Conduct Model Integration	4.4.10					/			Level II lead activity. CSA will provide available program information to Level II on request, or provide access to data at Spar.
Step 11: Quantify Integrated Model	4.4.11							/	Level II lead activity
Step 12: Develop Importance Rankings for Risk Management	4.4.12							/	Level II lead activity

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309 MEETS OR EXCEEDS SUBMISSION									
NASA DOCUMENT		**SPAR–SS–PL–0273 CSA DOCUMENT**		**SPAR–SS–PP–0096 CSA Document**		**MEETS OR EXCEEDS**			**COMMENTS**
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	**YES**	**NO**	**N/A**	
RESPONSIBILITIES FOR PERFORMING QUANTITATIVE SAFETY RISK ASSESSMENT	4.5					/			Level II lead activity. CSA will provide available program information to Level II on request, or provide access to data at Spar.
CRITERIA FOR PERFORMING QUANTITATIVE SAFETY RISK ASSESSMENT	4.6					/			Level II lead activity. CSA will provide available program information to Level II on request, or provide access to data at Spar.
SAFETY RISK REPORTING AND DOCUMENTATION	4.7							/	Level II activity
RISK CONTRIBUTOR LIST RESOLUTION FOR SAFETY RISK MANAGEMENT DESCRIPTION	4.8							/	Level II activity
HAZARD CLOSURE AND APPROVAL	5.0					/			CSA will support the Hazard Closure and approval process described in SSP 30599 and the Safety Review Panel.
PURPOSE	5.1					/			See “5.0”
DESCRIPTION	5.2					/			See “5.0”
HAZARD REDUCTION PRECEDENCE SEQUENCE	5.3			HAZARD ELIMINATION AND CONTROL	4.4	/			
Raising Damage Threshold	5.3.3							/	deleted
Closure Status and Rationale	5.4							/	Title
Status	5.4.1							/	Title
Open Hazard	5.4.1.1					/			Definition
Closed Hazard	5.4.1.2					/			Definition
Closure Rationale	5.4.2					/			Title

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309
MEETS OR EXCEEDS SUBMISSION

NASA DOCUMENT		SPAR–SS–PL–0273 CSA DOCUMENT		SPAR–SS–PP–0096 CSA Document		MEETS OR EXCEEDS			COMMENTS
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	YES	NO	N/A	
Eliminated	5.4.2.1					/			See “5.0”
Controlled	5.4.2.2					/			See “5.0”
Accepted Risk Level	5.4.2.3					/			See “5.0”
Closure Approval Signatures	5.4.3					/			CSA will comply with sign–off requirements
SAFETY ASSESSMENT REPORT	6.0	MSS Milestone Reviews Safety Reviews and Boards	3.3.1 3.3.2			/			(SAR will be reformatted in 0273 to correspond to 30309 format)
MISSION INTEGRATED SAFETY ASSESSMENT	6.1							/	Requirement on Level II
FREEDOM SAFETY REVIEW PANEL	7.0	Safety Reviews and Boards	3.8.2			/			
GROUND SUPPORT EQUIPMENT (GSE)	8.0			INDUSTRIAL SAFETY	5.0	/			
HAZARD IDENTIFICATION	8.1	HAZARD IDENTIFICATION DATA SOURCES IDENTIFICATION OF GENERAL HAZARD IDENTIFICATION OF FAULT RELATED HAZARDS	2.1.2 2.1.3 2.1.4	SAFETY ANALYSIS GSE Safety	4.3 4.9	/ /			
HAZARD CLASSIFICATION	8.2	Hazard Severity Classification	2.1.1	GOVERNMENT FURNISHED EQUIPMENT (GFE) INTEGRATION GSE SAFETY	4.8 4.9	/			(Frequency of occurrence will be added to 0273)
SPACE STATION GROUND SUPPORT EQUIPMENT HAZARD DATABASE	8.3	Format and data element descriptions	3.2			/			
SPACE STATION GROUND SUPPORT EQUIPMENT HAZARD DATABASE REQUIRED DATA FIELD	8.3.1					/			(F&DE descriptions will be aligned with 30309)

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30309 MEETS OR EXCEEDS SUBMISSION									
NASA DOCUMENT		**SPAR–SS–PL–0273 CSA DOCUMENT**		**SPAR–SS–PP–0096 CSA Document**		**MEETS OR EXCEEDS**			**COMMENTS**
DESCRIPTION	PARA.	DESCRIPTION	PARA	DESCRIPTION	PARA	**YES**	**NO**	**N/A**	
HAZARD REPORT FORM	8.4							/	Level II TMIS generates report
APPENDIX A ABBREVIATIONS AND ACRONYMS								/	Appendix A is not mandatory
APPENDIX B GLOSSARY								/	Appendix B is not mandatory
APPENDIX C EXAMPLE OF A COMPLETED ENTRY INTO THE HAZARD DATABASE								/	Appendix C is not mandatory
APPENDIX D SOFTWARE ANALYSIS TECHNIQUES								/	Appendix D is not mandatory
APPENDIX E SOFTWARE ANALYSIS TOOLS								/	Appendix E is not mandatory
Appendix F Fault Tree Analysis								/	Appendix F is not mandatory
Appendix G NASA Data Requirements (DR)						/			
Appendix H Example of Space Station Hazard Report		Appendix A						/	Appendix H is not mandatory. However CSA has a similar appendix in SPAR–SS–PL–0273

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30233
MEETS OR EXCEEDS SUBMISSION

SSP 30233 Issue C Para No	Paragraph Title	SPAR–SS–SG–0098 Issue C	SPAR–SS–PL–0383 Issue B	Other	Meets/ Exceeds	Rationale
3.0	GENERAL REQUIREMENTS	4.1 / 4.2			YES	Property and operational requirements are addressed
3.1	MATERIALS AND PROCESSES,SELECTION, CONTROL AND VERIFICATION PLAN		1.3	SPAR–SS–PP 0095 REV E para 4.5	YES	SPAR–SS–PP–0095 Rev E, Product Assurance Program Plan Space Station MSS requires an M&P control program in accordance with SPAR–SS–PL–0383 M&P Selection, Control and Verification Plan.
3.1.1	Method for coordinating, approving and tracking....	4.3.1 / 4.3.2	4.6		YES	
3.1.2	Contractor responsibility for release of all eng docs	4.3.2	4.2		YES	
3.1.3	M&P procedures and usage		4.5 / 4.6			
	1) Engineering control and release system and automation	4.3.1 / 4.3.2	4.6		YES	The MIUL lists are under Config. control and the Config Mngmnt. requirements are such that control and traceability is maintained for each item on the list.
	2) Non–Preferred materials and process usage (MUA)	4.3.1 / 4.3.3	4.7 / 4.3		YES	MUAs are required for all materials not conforming to requirements of SPAR–SS–SG–0089B
	3) Flowdown of M&P requirements to vendors	2.0	4.8		YES	M&P requirements are applied to lower level subcontractors and to their contractors.
	4) Batch/Lot acceptance	4.3.2			YES	
	5) Periodic reviews			SPAR–SS–PP 0095 Rev E Para 3.5	YES	CSA/Spar Product Assurance conducts regular reviews/surveys of all prime and subcontractor MSS activities
3.2	MATERIALS AND PROCESSES SPECIFICATIONS	4.3.1 / 4.3.4 / 4.3.5	4.4		YES	CSA critical processes/procedures include operator training and certification. The Fracture Control program is described in SPAR–SS–PL–0888 Fracture Control Plan.
3.3	MANUFACTURING PLAN	4.3.4	4.9		YES	
3.4	CONTROLLING DOCUMENTS	4.3.1	4.4	SPAR–SS–PP–0098 Issue C Para 7.3	YES	

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30233 MEETS OR EXCEEDS SUBMISSION						
SSP 30233 Issue C Para No	Paragraph Title	SPAR–SS–SG–0098 Issue C	SPAR–SS–PL–0383 Issue B	Other	Meets/ Exceeds	Rationale
3.5	MATERIALS CERTIFICATION AND TRACEABILITY	4.3.2 / 4.2(e)	4.4		YES	SPAR–SS–PP–0098 Mobile Servicing System QA Plan requires the inspection of all incoming materials, SPAR–SS–SG–0089 requires the traceability to batches or lots
3.6	RESERVED					
3.7	CLOSE–OUT PHOTOGRAPHS	4.4	4.4		YES	
3.8	MATERIAL DESIGN ALLOWABLES	5.1.1.1/ 5.2.2.1	4.1		YES	
4.0	DETAILED REQUIREMENTS					
4.1	METALS	4.2 / 5.1.1.2	4.7		YES	
4.1.1	ALUMINUM	5.1.2			YES	
4.1.2	STEEL	5.1.5			YES	
4.1.2.1	Heat Treatment	5.1.5(c)			(YES)	CSA requires treatment to be given within 3 hours of exposure for HRC41 and within 4 hours for HRC 35–41. Materials not meeting these requirements are subject to an MUA
4.1.2.2	Drilling and Grinding of High Tensile Steel	5.1.5c			YES	
4.1.2.3	Corrosion Resistant Steel	5.1.5a			YES	Not applicable; Spar only welds stabilized or low carbon grade steels 321,347,316L, 340L
4.1.2.4	Precipitation Hardening Stainless Steel	5.1.5a			YES	Exceptions are subject to MUA process.
4.1.3	TITANIUM	5.1.7a / 5.1.7b / 5.1.7(c)			YES	Exceptions are subject to MUA process
4.1.3.1	Heat Treatment	5.1.7(c)			YES	
4.1.3.2	Titanium contamination	5.1.7a			YES	CSA/SPAR documentation prohibits the use of chlorinated cleaning and machining fluids, hydrochloric acid, methyl alcohol, mercury and its' compounds on MSS titanium items.
4.1.3.3	Fretting of Titanium	5.1.7a			YES	
4.1.3.4	Titanium Welding	5.3.1g			YES	CSA/SPAR prohibits the use of CP wire

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30233 MEETS OR EXCEEDS SUBMISSION						
SSP 30233 Issue C Para No	Paragraph Title	SPAR–SS–SG–0098 Issue C	SPAR–SS–PL–0383 Issue B	Other	Meets/ Exceeds	Rationale
4.1.4	MAGNESIUM	5.1.4			YES	Protection as per MIL–M–3171 or MIL–M–45202 is provided in corrosive environments
4.1.5	BERYLLIUM	5.1.3			YES	Copper/Beryllium alloys are heat treated to MIL–H–7199
4.1.6	CADMIUM	4.2(c)			YES	CSA prohibits the use except in hermetically sealed devices.
4.1.7	MERCURY	4.2(d)			YES	CSA prohibits the use except in hermetically sealed devices
4.1.8	REFRACTORY METALS	4.1(c)			YES	Refractory metals are tested for chemical, tensile, hardness and thermal property characteristics as appropriate to their particular application.
4.1.9	SUPERALLOYS (NICKEL–BASED AND COBALT–BASED)	5.1.6			YES	
4.2	NONMETALLIC MATERIALS					Title
4.2.1	GENERAL REQUIREMENTS	5.2.1.3/6.1.1			(YES)	Except for odour. MSS provided material is external to habitable areas
4.2.2	ELASTOMERIC MATERIALS	5.2.1/5.2.2(d)			YES	The use of Elastomeric materials for SSFP is derived from the approved materials list used for the SRMS
4.2.3	POLYVINYLCHLORIDE	5.2.2.1(b)			YES	
4.2.4	FIBER REINFORCED PLASTICS	5.2.2.1(e)			YES	
4.2.5	LUBRICANTS	5.2.2.2			YES	Lubricants containing CFC’s are not used on CSA MSS. NASA SP 8063 and NASA CR–16109 are used as design guides in place of NASA–TM–86556.
4.2.6	LIMITED–LIFE ITEMS	5.2.1.2			YES	ORUs with a Limited Life are designed against a requirement for a 10 year life with replacement
4.2.7	VACUUM OUTGASSING	5.2.1.1/6.1.1	4.7		YES	
4.2.8	ATOMIC OXYGEN EFFECTS	5.2.1.4			YES	Organic materials are protected from effects of atomic oxygen, the protection procedures are under the control of csa.

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30233 MEETS OR EXCEEDS SUBMISSION						
SSP 30233 Issue C Para No	Paragraph Title	SPAR–SS–SG–0098 Issue C	SPAR–SS–PL–0383 Issue B	Other	Meets/ Exceeds	Rationale
4.2.9	RADIATION	4.1/6.1.1			YES	Where suitable test data does not exist, testing will be performed.
4.2.10	MOISTURE AND FUNGUS RESISTANCE	5.2.1.5			YES	
4.2.11	OTHER NONMETALLIC MATERIALS	6.0			YES	SSP 30246 not released on program
4.3	PROCESSES					Title
4.3.1	FORGING	5.1.1.5			YES	CSA/SPAR uses ultrasonic, radiographic and other NDT methods to ensure freedom from defects in accordance with MIL–STD–2154.
4.3.2	CASTINGS	5.1.1.4			YES	In addition to meeting MIL–STD–2175 for all castings, CSA requires that structural aluminum alloy castings conform to MIL–A–21180, and Titanium alloy castings to MIL–T–81915.
4.3.3	ADHESIVE BONDING	5.3.4			(YES)	In addition, CSA/SPAR requires all bonding operations to be performed by trained and experienced personnel. Adhesive bonding is not used as a primary structural bonding technique.
4.3.4	WELDING	5.3.1(b) / 5.3.1(c)			YES	CSA requires operator certification to MIL–STD–15954–1 or DF–49–001–024/SF/001.
4.3.4.1	Weld Repair	5.3.1(e)/ 5.3.1.(f)			YES	All weld repairs are subject to MRB approval.
4.3.4.2	Weld Filler Metal	5.3.2(d)			YES	Spliced wire is not used. Each spool is tested before use and again at random intervals to verify composition.
4.3.4.3	Aluminum Welding	5.3.1(g)			YES	CSA/SPAR restricts welding to AA6061, AA6063 and AA2219 heat treatable alloys. Welding of all alloys is subject to MSFC–SPEC–504 under control of internal procedures.
4.3.4.4	Welding of Steel Alloys	5.3.1(g)			YES	
4.3.5	BRAZING	5.3.2			YES	In addition, CSA requires traceability of each braze to the operator, inspector and brazing schedule number, and prohibits use of certain Aluminum alloys and Titanium.
4.3.6	SOLDERING	5.3.3			YES	

NASA/CSA CROSS REFERENCE MATRIX FOR SSP 30233 MEETS OR EXCEEDS SUBMISSION						
SSP 30233 Issue C Para No	Paragraph Title	SPAR–SS–SG–0098 Issue C	SPAR–SS–PL–0383 Issue B	Other	Meets/ Exceeds	Rationale
4.3.7	ELECTRICAL DISCHARGE MACHINING	4.3.4			YES	The EDM manufacturing process under which critical items are manufactured is documented, verified, sampled and qualified, with results recorded.
4.3.8	PERSONNEL QUALIFICATION/TRAIN–ING	4.3.4			YES	CSA requirements are limited to processes used on MSS.
4.4	MATERIAL NONDESTRUCTIVE INSPECTION	4.4			YES	
4.5	SPECIAL MATERIALS REQUIREMENTS					Title
4.5.1	RESIDUAL STRESSES	5.1.1.2			YES	
4.5.2	SANDWICH ASSEMBLIES	5.2.2.1(f)			YES	
4.5.3	COMPOSITES	4.3.4/5.2.2.1			YES	Specific use of fiber reinforced plastics governed by MIL–HBK–17
4.5.4	CORROSION PREVENTION AND CONTROL	5.1.1.3			YES	M&P Selection, Control and Verification Plan, SPAR–SS–PL–0383. All materials are protected from corrosion in accordance with MSFC–SPEC–250A, including dissimilar metals as defined by MIL–STD–889.
4.5.4.1	Steel	5.1.1.3			YES	Protection employed subject to CSA approval.
4.5.4.2	Sealing	5.1.1.3			YES	CSA/SPAR practice is that all surfaces between dissimilar materials are protected, not just those between galvanic metals
4.5.4.3	Fastener Installation	5.3.5			YES	CSA/SPAR prohibits these – use of any fastener, other than titanium, for more than 3 times.